# EDITORIAL

A FAMILIAR photograph and signature are missing from the page this month, because an expected letter from the Editor had not arrived by the time this issue went to press. Accordingly, I looked out the old signature, which has not appeared here since January, 1946. The photograph which once accompanied it is no longer applicable!

Elsewhere in the issue, we publish circuit details of a full-scale television receiver, designed in Australia for local conditions and components. It should give readers a firm appreciation of what such a design entails. The circuit is fairly advanced in its general conception, but is not by any means extravagant.

To some readers, it will not be "news". To many others it will come as a rather appalling experience to count the 21 valves, many of them multiple types, to view the bulky list of components and to read the design background to each major section of the receiver. The designer has suggested a few ways in which it could be simplified; a valve here, a few parts there but, at best, a reduction in complexity of a mere few per cent.

The truth of the matter is that there is no such thing as a "crystal set" television receiver or even a "Little General". The number of tubes and parts doesn't diminish in proportion to the size of the picture. By the time a designer has provided the time bases, the sync. circuits, the sound channel, a power supply and a bare minimum of RF performance—without these, the programme cannot be received at all — the circuit is already complex by our current standards.

Can a TV set be built in the home? That question is being put to us time and again. What do you think as you look at the circuit on page 49? And how would you face up to the problems of alignment and adjustment, which dwarf those encountered in a conventional set? The proposition is one which the Editor is examining overseas, at the moment. When we've found a satisfactory answer and seen to it that a complete kit of parts is available, then and only then will we encourage you to enter a shop, cheque in hand.

At the same time, we are not overlooking the "experimenters" approach. If it's a proposition at all to build up something useful from disposals parts, which will gain you knowledge and experience, we'll do our best to show the way.

That's our job in life!

W. M. Williams

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RADIO TELEVISION & HOBBIES

A NATIONAL MAGAZINE OF RADIO, TELEVISION, HOBBIES AND POPULAR SCIENCE

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## OUR COVER PICTURE

Television receiving aerials are not normally assembled on the front lawn by a couple of models, whatever attractions the idea might hold. Many, like this fan-type, will be installed in Sydney and Melbourne, during the next few months. Transmissions are likely to begin about November 1.

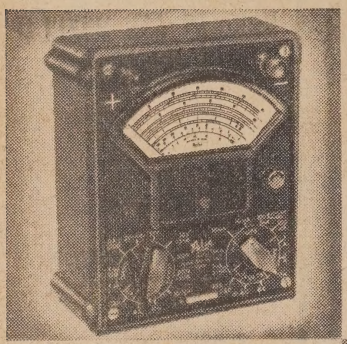
# Palec 5 PRE-EMINENT MULTI-RANGE INSTRUMENTS

By

**Paton Electrical Pty. Ltd.**

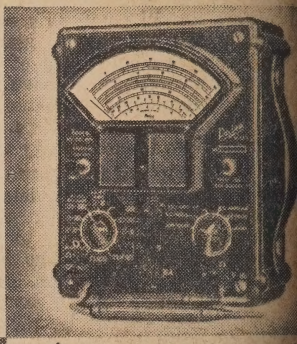
## COMMON FEATURES

**COMMON FEATURES of Models 52, 47 and 42:— Semi hard rubber housing (as illustrated) Spring loaded Jewel bearing meter movement to minimise effect of shocks. Range Steps — 1, 3, 10, 30 etc. High accuracy and quality.**

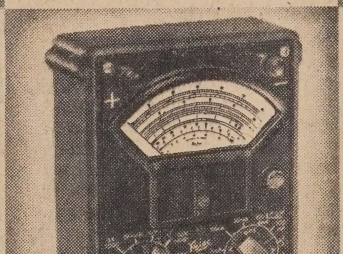


**MODEL M42. Forty-two range** General Purpose Multimeter:—
Current: AC to DC to 10 Amps.
Voltage: AC and DC to 1000 Volts.
Resistance: 0-5 Megohms (Int. Batteries).
Decibels, Capacity, etc.
**Price on application.**

**MODEL M52. Fifty-two range** Radio and Electrical Multimeter:—
Current: DC to 1 Amp.
Current: AC 0-1 mA (for use with ext. C.T.)
Voltage: AC and DC to 1000 Volts.
Resistance: 0-1 Megohm (Int. Battery).
Decibels, etc.
**Price on application.**



**MODEL M52.** Fifty-two range Laborat Multimeter covering:—
Current: AC and DC to 30 Amps.
Voltage: AC and DC to 1000 Volts.
Resistance: 0-3 Megohms (Int. Batterie Decibels, Output, etc.
COMPLETE OVERLOAD PROTECTION
**Price on application.**



**MODEL OM2. Four range** Ohm-meter 100,000 Ohm, featuring a Special range 0-10 Ohm (1 Ohm centre sca Housed in portable Bakelite case.
APPROVED BY N.S.W. MINES DE APP. No M.D.A/G-82
Suitable for testing Detonators.
Internal batteries—Max. drain 15 mA
**Price on application.**

**MODEL M47. Forty-seven range** Television Multimeter, 20,000 Ohms Per Volt.
Current: AC and DC to 10 Amps.
Voltage: AC and DC to 3000 Volts.
Resistance to 50 Megohms (Int. Batteries) to 500 Megohms (ext. DC Supply).
Decibels, Output, etc. Overload METER PROTECTION
**Price on application.**

## SEND FOR DESCRIPTIVE LITERATURE

### SERVICE

Our Australian-built products have the advantage of being backed by local factory Services.

### TECHNICAL PROBLEMS

Our Technical facilities are at your disposal

Australian Agents for
MEGATRON PHOTO-ELECTRIC CELLS

**Paton Electrical Pty. Ltd.**

**ASHFIELD, SYDNEY • UA 5266 (5 lines)**

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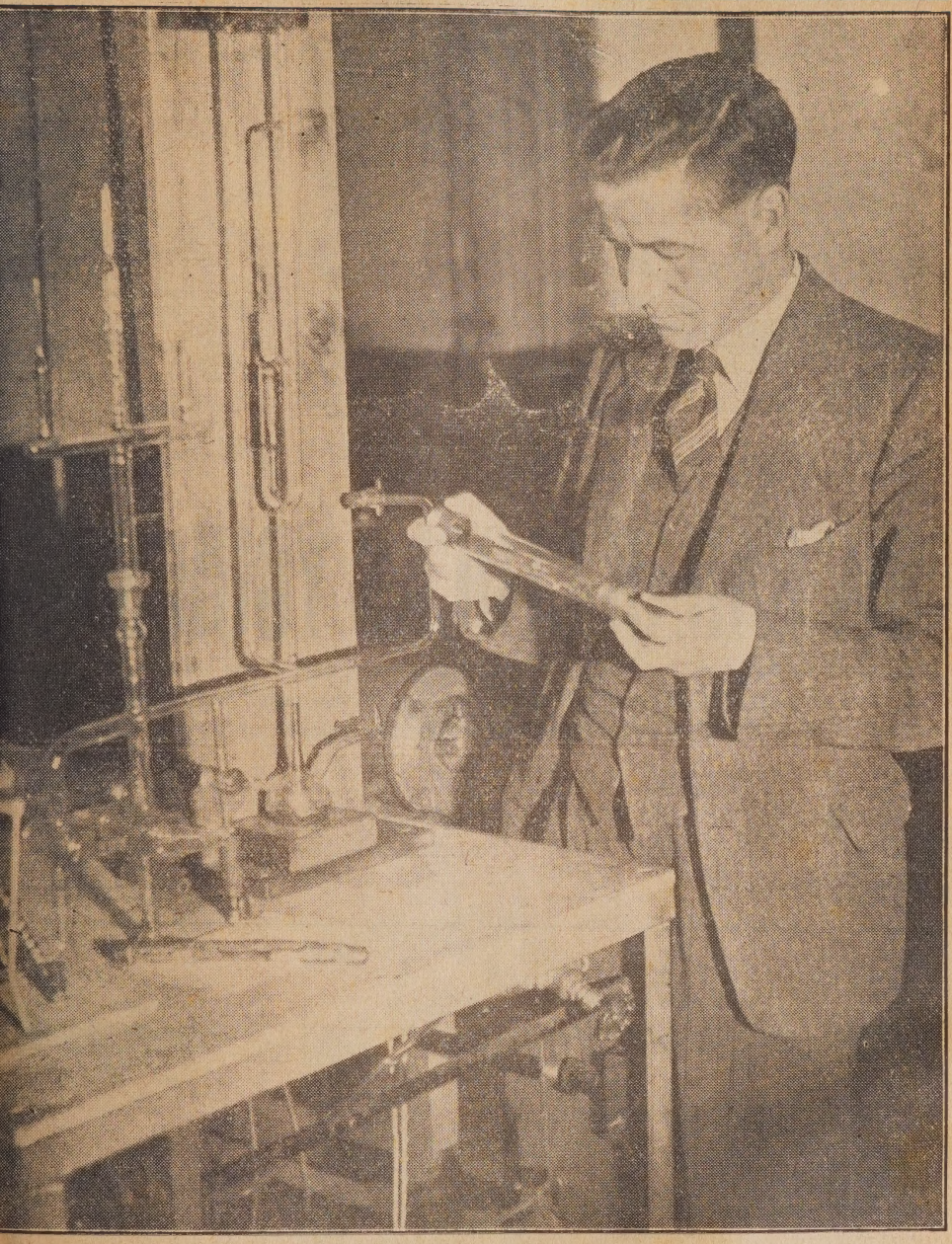
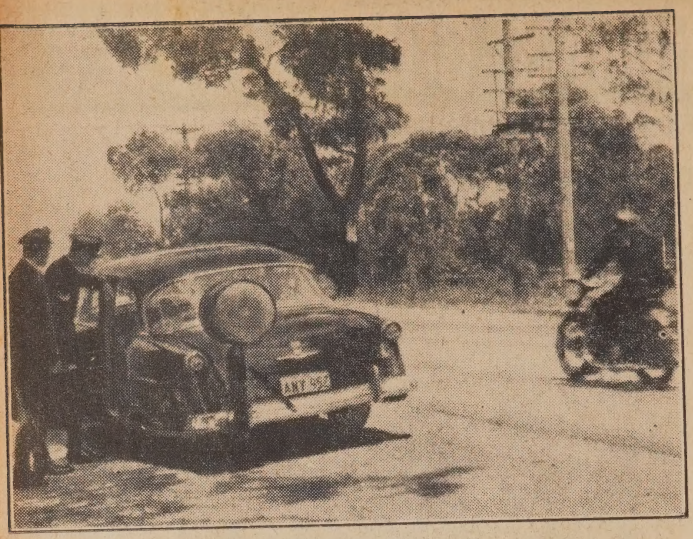
# GAS ARC BURNS CONTINUOUSLY



us arc lamps have already found wide application for flash photography, ranging from wartime aerial photography to
le electronic flash equipment, used by amateurs and professionals alike. Now Dr. J. N. Aldington, of Siemens Electric Lamp
tory, Lancashire, has succeeded in producing the gas arc seen above, which is capable of burning continuously, instead of
limited to short duration flashes. Though application photography, film studios, television, &c, is possible, economic and
ercial possibilities have not yet been assessed. This photograph was taken with another such lamp, burning continuously, two
feet from the subject. Exposure was one fiftieth of a second, stopped to 6.3.



Parked beside a New South Wales highway, two traffic policemen check the accuracy of their radar gear, with the aid of a third, riding a solo motorcycle. Expert testimony in court set the maximum possible margin of error at about 2 pc.

cussion to variations on the basic theme which enable engineers to adapt electronic equipment to so many needs.

Most common is the use of radar for checking the speeds of erring motorists. Some drivers call it the "invisible cop", because often there is no indication that a speed trap has been laid until the muttering motorist appears in court. Even then he cannot argue back, because a permanent record of his exact speed has been recorded by a little black box.

Few drivers realise the accuracy and simplicity of the radar trap. Some authorities put up a warning sign, but this is often ignored by motorists, who reason "How can a policeman prove I was speeding when the road is cluttered up with so many other vehicles?" Alas, poor man, he ends up surely and certainly with a speeding fine, bewildered that a box full of assorted wires, tubes and components can convict him of a traffic offence.

In court, the driver is presented with an impressive-looking graph on which is marked a multitude of thin red lines ranging across the squares from zero to 70 mph. At one end of the high-speed lines, like the judge's sole piece of evidence—the licence number of the car, with the time, date, place and initials of the constable operating the instrument.

# HOW RADAR CLOCKS YOUR SPEED

**Radar—once a top aeronautical secret—is now a common part of the highway scene. In Australia and overseas 'radio detection and ranging' (as it was called before air-force boffins contracted the name) is being adapted for a growing number of automotive needs.**

ALREADY Detroit manufacturers are operating prototype models with built-in radar brakes. Many overseas highways rely on radar traffic lights, and here in Australia the police force is using "invisible" electronic patrol men to keep down the numbers of speeding motorists.

In many countries, new networks of roads are designed to be operated in conjunction with radar controls, which speed up or slow down the flow of traffic according to the road conditions.

Readers of this magazine will be familiar with the general lines on which radar works. In these pages, therefore, we are confining the discussion to the use of radar for checking the speeds of erring motorists. Some drivers call it the "invisible cop", because often there is no indication that a speed trap has been laid until the muttering motorist appears in court. Even then he cannot argue back, because a permanent record of his exact speed has been recorded by a little black box.

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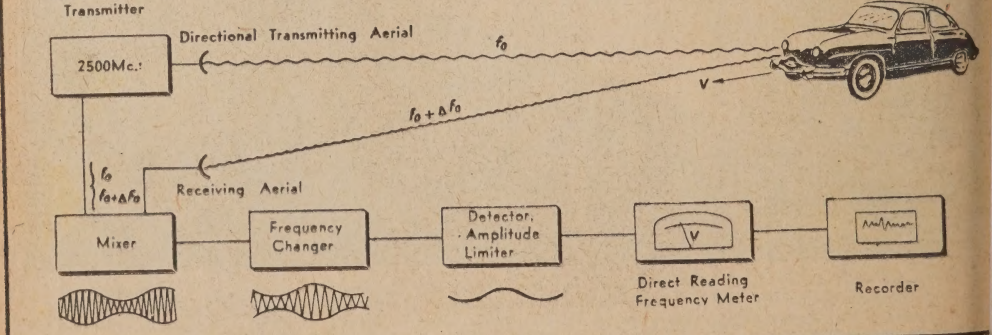
But what is the chain that leads from the little black box on the side of the highway to the witness box in a magistrate's court?

Highway radar sets are the direct, if somewhat remote, descendants of the radio locators used during World War II to determine the speed and location of enemy aircraft. Oft




Despite the reputation of their drivers, Frenchmen have their troubles, too. With this diagram, Lucien Chretien explained the operation of the speed check system to his countrymen.

e car-driver now is no more aware their presence than the wartime ot.

The apparatus consists of a trans-tting and a receiving unit built o one cabinet.

The transmitter beams a signal on an oncoming (or departing) car l the receiver picks up the beam flected back from it.

By way of illustration, a trans-tter might direct two distinct sts of signal against a STATION-Y car. In the normal way, two responding "echoes" would be re-ted back to the receiver, the two oes being separated by exactly same time interval as the two inal signals.

directed against an oncoming however, the second signal would e a shorter distance to travel than first and the echo would there-return with slightly less delay.

y assessing electronically the y between each burst and its echo, the DISTANCE TO the car be determined. On the other d, by noting how much closer ther the echoes are than the sts it is possible to obtain an in-tion of SPEED.

## ED THAT MATTERS

ince traffic police are interested in this latter information, their er is designed accordingly. In ny cases, a continuous signal is ected against the oncoming car its echo or reflection comes back tly raised in frequency. It is ually the well-known "Doppler" ct in another guise—the effect ch makes the whistle of an on-ing train sound higher in pitch it really is.

he radar receiver heterodynes the against the signal originally smitted to discover the differ-between them.

his "difference" frequency, which roportional to the speed of is then amplified and used to ate a frequency measuring cir-. The higher the speed of the ming car, the further does the uency meter swing over and the er the constable jabs at his book!

n "official" description of how l works was made in court re-ly by Mr. Harry C. Minnett, ipal research officer of the io-Physics Section of the Coun-f Scientific and Industrial Re-ch Organisation (who built ralia's first highway radar unit)

## W IT WORKS

ving evidence against a speed-notorist, he said that there was ransmitter in the equipment h fed energy to an aerial send-ut a beam of radio waves. Any ng object in the beam induced e receiver an alternating elec-l current, whose frequency was tly proportional to the speed of vehicle. The function of the ment, said Mr. Minnett, was to measure that frequency and t the results in miles per hour meter.

here are two things which must rrect in order to ensure the ac-y of the equipment," he ex-ed. "Firstly, the transmitting uency must be tuned to a pre-mined value. Secondly, the uency measuring unit must be rly calibrated.

his machine was invented in Zealand by the Dominion Phy-

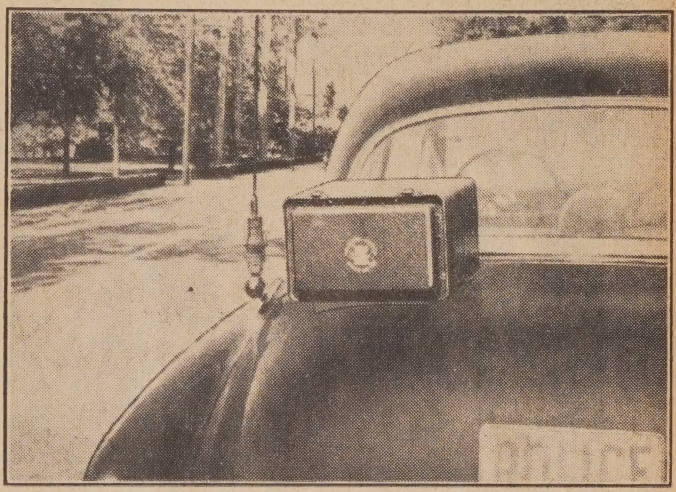
# by Pedr Davis

sical Laboratory. We built it and there is no possibility of miscalculation by it.

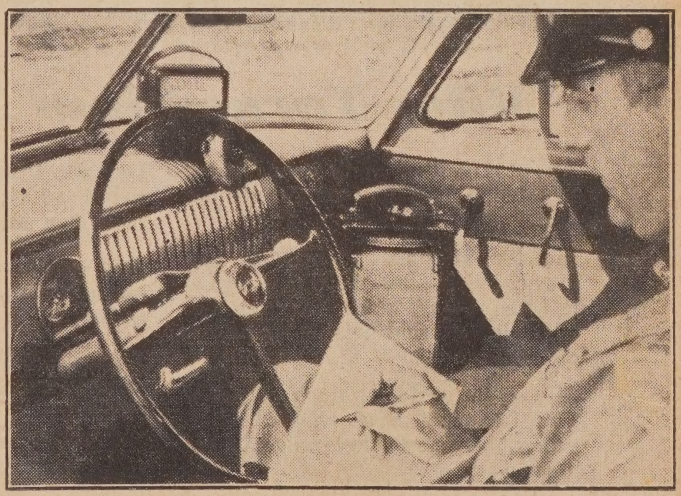
"It is our practice to calibrate the machine from time to time and I have estimated that the possible error at 45 mph would not be more than plus or minus 2.1 pc, or plus or minus 1 mph."

American-type radar equipment emits signals at regular intervals and it is therefore possible to know how far the car has travelled between the firing of two subsequent beams. If, for the sake of an example, the beams are sent out every tenth of a second and it is found that the car has travelled 9.6 feet between the time the first and second beam has bounced back, then clearly it is merely a mathematical calculation to find out how fast the car must be travelling.

The little black box takes care of this sum, too, with amazing speed and precision. Using the formula to determine the speed of an object by time over a given distance, the electronic "brain" delivers the answer in 3-10 second. The radar stylus then moves over the graph to make




"The little black box", well known to American motorists, nestles on the rear of a police car. See picture below:



Inside the patrol car, a US traffic officer watches the meter which reads the speed of passing traffic directly in miles per hour. Licence numbers of offending cars are jotted down, while a recording stylus unerringly records the speed on a moving graph also visible in the picture.

*A P.M.G. team securing an underwater cable on the shore of Apollo Bay, Vic.*

# *Miles Turned into Minutes*

Almost 40 million words were received by cable in Australia from overseas last year.

Birthday greetings . . . wedding congratulations . . . news that you were glad to hear, or news which made you sad. They all were vital links in the pattern of living.

All over the world, telegraph and cablegram messages have removed international barriers and have reduced miles to minutes.

**Leakage Prevented.** It is a never-ending task to keep millions of miles of cable lines working efficiently.

Shell scientists have discovered that a casting resin* derived from petroleum can be used for cable splicing.

Treatment with this SHELL product seals cables completely and the seal does not deteriorate.

**Epikote Resin*

# ECHOES CHART THE OCEAN FLOOR

The day of the sounding line has gone forever. Now, sailors of the R.N. sit in the comfort of a cabin while sonic impulses bounce back from the sea-bed and indicate the depth of water every three feet along the allotted course.

nark against the appropriate
d.
e beam of the unit is set at a
ow angle so that it strikes only
car at a time. The operator
fore knows that there is only
car in the checking area, and
accelerating or slowing down
not confuse the result.
the speed is shown to be ex-
ve, the operator marks down
ar's number against the appro-
e line on the graph and he also
s a call to another patrol out
ght down the road. They flag
the driver.
e radar speed traps can be
d almost anywhere. Some
orities operate the equipment
the back of a police vehicle
ng down the main road. In
rica, some sets are housed in
ble huts. A motorist speeding
nd a corner, suddenly finds him-
passing a radar trap before he
slow down. The huts are, of
e, portable so that they can be
d once their whereabouts is
non knowledge.
netimes, police operate from
r-leaf crossings so that the cars
e timed from a height
ice also resort to other subter-
. They learned their lesson
the nazis during the war, who
ed that fear alone can halt an
army. They used to plant
mely sensitive mines every
or four miles and accompany
with a warning sign. The
forces sometimes spent hours
to locate the danger before
ng on. Often there was no mine
at all.
erican police work the same
. They plant signs reading,
RNING. RADAR TRAP IN
RATION".
pite the signs, no radar apparat-
within miles. "It works won-
said one official. "As soon
e motorist sees the sign, he
down!"

## AR" LIGHTS

n State tried a very interesting
on of this psychology. They
d across the road a rubber hose
n it looked like a crack in the
ete. As soon as a car passed
rit, a radar timer was actuated
clocked the speed of the car.
the pace was excessive, the
ous mechanism sets off a siren
screams weirdly and can be
by the speeding driver and
other people in the neighbor-
Under these circumstances,
drivers fail to slow down.
ar is also finding increased ap-
ion in traffic light systems. Al-
more expensive to intal,
find considerable favor be-
the electronic units are cheaper
intain and capable of control-
affic much faster than conven-
lights.
see how this works, let us
look at a normal system.
ar passing over an air-filled
on strip causes an increase in
re which reacts against a dia-
m. A trigger is then operated
interrupts the change of lights
nce.
h some lights, the colors change
initely timed periods, adjust-
a study of the flow of traffic
the route. Radar devices,
ver, change in direct relation
flow of motor vehicles.
are beamed in the direction
traffic, and the presence of
loving object approaching (but not travelling away) will cause an impulse on the change-light sequence mechanism. The beam is set to react only to vehicles travelling in the "10-40 mph" speed range, so that stationary vehicles will not effect the sequence of lights.

The aerials are normally mounted at the centre of the intersection, and the two opposite aerials are inter-connected to allow operation of the signals by vehicles approaching in opposite but parallel directions.

Although the cost of the radar equipment is higher than the conventional type, there is no expensive road installation needed, and no replacement needed for the quickly wearing rubber strips.

Theory shows that radar systems should be able to provide the ideal type of traffic signal, allowing the right of way to the stream of cars with the highest pressure. They have a long effective range, and can "pick up" an approaching vehicle when it is a considerable distance away.

## FUTURE USE

Initial experiments are working well, and it is now probable that radar-operated traffic lights will be in general use within the next few years.

So also will radar-controlled brakes for motor cars. Although this may sound like a piece of science fiction, it is a very practical reality.

Earlier this year, a Detroit safety engineer built a device which uses radar to automatically operate the power brakes of a vehicle when anything appears in its path. A radar unit is mounted below the front grilles (a similar device can be mounted on the rear for reversing) and projects a pair of beams ahead. The faster the car goes, the further ahead the beams are thrown. As soon as one is interrupted, a trip mechanism applies the brakes until either the car stops or the obstacle is removed.

The system appears to be most successful. The inventor equipped a pair of cars with radar and invited the drivers to try and crash head on at 50 mph. On all occasions, the cars pulled up long before a collision occurred. The system only works when the car is doing at least 10 mph.

One American car manufacturer is said to be so interested in the experiments that his engineers are working frantically to perfect the system in time to make an appearance on the 1957 models.

Another aspect of electronic application to the motoring world is the extensive use now being made in America of a system for marshalling motorists. In New Hampshire, a roadside neon sign flashes a warning to motorists when they are exceeding the speed limit on the Seacoast Turnpike. Every car passes the radar "eye", but no permanent record is kept of the vehicle's speed.

In a new freeway at Detroit, a complete system of control has been incorporated. Using a network of radar observers at important junctions, a single monitor is able to keep track of the traffic congestion along the highway. Thus when there is a build-up of cars, an accident, or any other reason to call for caution, he can flash out "Slow Down" messages on neon indicators along the road side.

And what of the future?

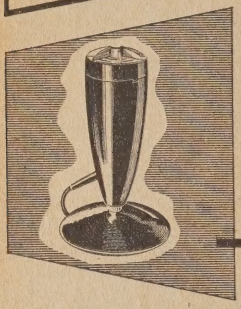
Many experts predict that in due course the motor cars on the major highways will "come in" on an electronic beam just as commercial aircraft are guided into the international airports.

acos

A COMPLETE RANGE

CRYSTAL MICROPHONES
MICROPHONE INSERTS

FOR EVERY PURPOSE

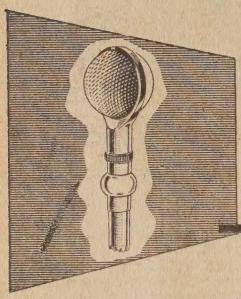


**DESK or HAND MICROPHONE, MIC36**

This Microphone is ideal for home recording and public address, etc. Response unexcelled for its size and price. The performance is not affected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s. Recommended load resistance not less than 1 megohm, dependent on low frequency response. Can be supplied complete with switch and floor stand adaptor, as required, at a small extra cost. **PRICE, £6/18/6.**

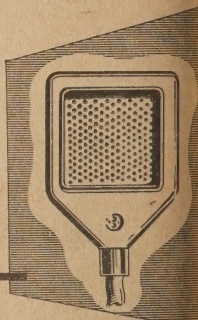
**TABLE or STAND MICROPHONE, MIC22**

This omni-directional Microphone is robust in construction, with a pleasing appearance. Vibration, shock or low frequency wind noise will not affect the performance. The low frequency cut-off is dependent on the load resistance. The cut-off is given by the equation, F = 80 divided by R, where F = c.p.s., R = megohms. An adaptor (floor mounting) is available at low extra cost. **PRICE, £9/18/6.**



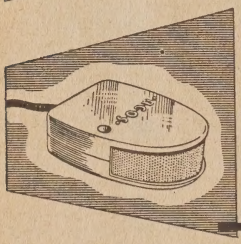
**HIGH-QUALITY MICROPHONE, MIC16**

This Microphone incorporates the world-famous floating crystal sound cell construction. Its fine performance is not affected by vibration or shock. The fidelity is not impaired by low frequency noise. **PRICE, £24/19/6.**



**LAPEL MICROPHONE, MIC28**

Designed to give freedom of movement, this Microphone is small and non-directional. Housed in a soft, moulded-rubber case, which gives protection against shock, it is provided with a pin at the rear of the case for pinning to the lapel. **PRICE, £5/19/6.**

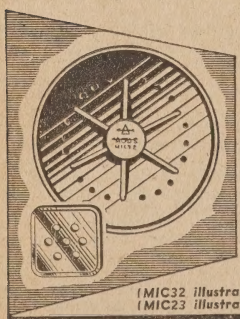


**GENERAL PURPOSE, MIC35**

The MIC35, is ideal for amateur transmitters, public address, etc. Housed in an attractive die-cast case, it features a high sensitivity and substantially flat characteristics. Provided with a built-in shunt resistance of 2 megohms, it will, when connected to the grid of the input valve, give a substantially flat response from 50 to 5,000 c.p.s. **PRICE, £2/15/-.**

**HAND or DESK MICROPHONE, MIC33**

This Microphone has been designed for the high quality public address and home recording field. High sensitivity and flat characteristics are obtained by a specially designed acoustic filter. Housed in an attractive plastic case with an unexcelled response for its size and price. Unaffected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s. **PRICE, £6/18/6.**



**CRYSTAL MICROPHONE INSERTS**

These inserts are available in varying sizes, ranging from as small as ⅛ in. square to 1-⅛ in. round, with various thicknesses from ⅛ in. to ⅛ in. Suitable for every purpose, such as hearing aids, public address, tape recording, amateur broadcasting, etc., they have responses from 2,250 c.p.s. to 3,500 c.p.s. at -5 db to -30 db. Insert can be supplied with or without 10 meg. resistor as required.

MIC19/4 and MIC32, **£2/15/6;** all others, **£1/19/6.**

*(MIC32 illustrated)*
*(MIC23 illustrated)*

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# FIRST ALL-COLOR TV STATION

**espite the high cost, both of receivers and program material, color television still con-nues to make progress in the US. NBC has recently announced the inauguration of the world's first all-color television station.**

e pioneer station is WNBQ, the owned station in Chicago, studios in the Merchandise

conversion to color involves emodelling of station facilities ie 19th and 20th floors of the building to accommodate three studios with five live and two ameras.

en the work is done, WNBQ egin telecasting all of its own y originated programs in color, dition to the frequent NBC rk color transmissions.

s will provide about 10 hours lor programs daily to viewers e Chicago area.

## E EXPANSION

WNBQ conversion is one of a 12,000,000-dollar plan nced by NBC to expand color sion facilities in New York, go, and Hollywood. The other ghts of the program are:—

onstruction of a second color udio at NBC's Color City in urbank, Calif.

onstruction of a second color udio in Brooklyn, in an area djacent to NBC's present color cilities there.

onversion of the Ziegfeld heatre in New York into a olor studio.

onstruction of an office build-ng at Color City.

ripling of technical work space Color City to house the new aster control, color-recording, lm broadcasting and other tech-ical facilities.

ddition of four new color film ains to the network's facili-es.

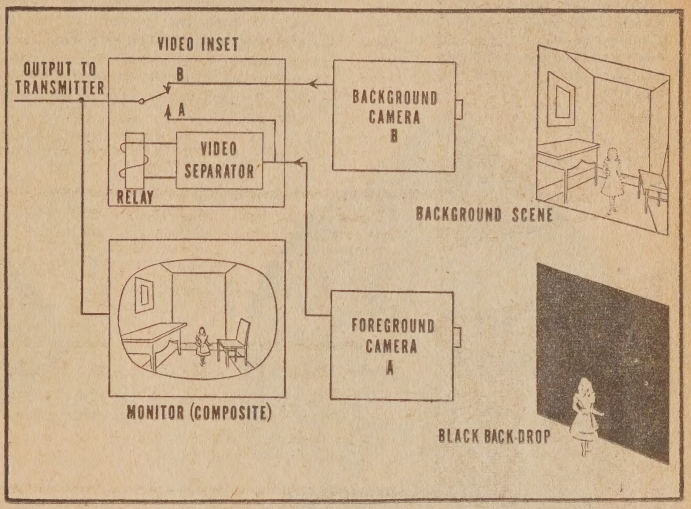
nstallation of equipment in olor City for recording color rograms for re-broadcast.

onstruction of the latest-type aster control centre at Color ity for all West Coast origina-ons, replacing the present aster control at the Hollywood udios.

WNBQ conversion plan, erect-new milestone in the advance or television, was announced g.-General David Sarnoff, dur-special Press conference which, proved the first inter-city use sed-circuit color television for purpose.

## WAY DISCUSSION

eral Sarnoff spoke before the TV cameras at NBC's Colonial e in New York City: with n the stage were New York representatives. The Chicago gathered at the WNBQ studios ng a question period follow-eneral Sarnoff's statement, a creen arrangement permitted ay vision and conversation over 0-mile distance.




Sketch shows how NBC's new color video inset employs two cameras to control foreground of a TV picture independently of the background to achieve novel effects.

As to the motives for establishing a local color program service, General Sarnoff stated his conviction that the future of television lies in color and cited the steps taken by RCA and NBC "to break through the black-and-white curtain" adding:

"Network color, which we pioneered, is now well established. Many outstanding television programs have been telecast in full color and even more are planned . . . But we know that network service must be supplemented by good local color programs. That is the next step that must be taken to make color television a full and complete service. That is the step we are taking now."

## ADDITIONAL STATIONS

Meanwhile six more television stations have decided to go in for original color telecasts with the help of RCA broadcast equipment, including the latest studio cameras for "live" color pickup, and the 3-Vidicon film system for telecasting color films and slides.

The new studio cameras are going to KMTV, Omaha; WJBK, Detroit, and WTAS, Norfolk, Va., while the 3-Vidicon film cameras have been ordered by the Omaha and Norfolk stations, as well as WTLP, Washington; KPRC, Houston, Tex., and WSLS, Roanoke, Va.

On the technical side, a series of visual effects new to live television programming have added spice to a number of NBC major color programs during recent months, marking the debut of a versatile new tool in telecasting.

The results appeared dramatically for the first time in Alice in Wonderland, when Alice seemed to shrink in size before the camera while surrounding objects remained unchanged.

## VIDEO INSET

In the Sadler's Wells Ballet production of Sleeping Beauty, Margot Fonteyn, as the princess, appeared in one scene to float before the camera as a vision brought to Prince Charming and his retinue in the magic forest.

Behind these and other novel effects in other major programs, lay an ingenious NBC system known as the "color video inset", employing two cameras in a way which permits the foreground of a picture to be controlled independently of the background.

It is regarded as one of the most important developments to come out of the NBC Engineering Department.

With the new system, producers can use camera techniques heretofore impossible in live color television. They can, for example, create giant "spectacles" in relatively small studios, and they can bring a live outdoor scene into the studio to be used as a background.

The "color video inset" works this way:

**(Continued on Page 114)**

# HI-FI ELECTROSTATIC TWEETE

LORENZ

*Now available in Australia from*

## AUDIO ENGINEERS PTY. LTD

*The Leading Sound Wholesalers*

Electrostatic tweeters reproduce those missing frequencies up to 20 Kcs. By adding one or more of these units to your equipment, the superb brilliance of modern LP recordings can be faithfully reproduced.

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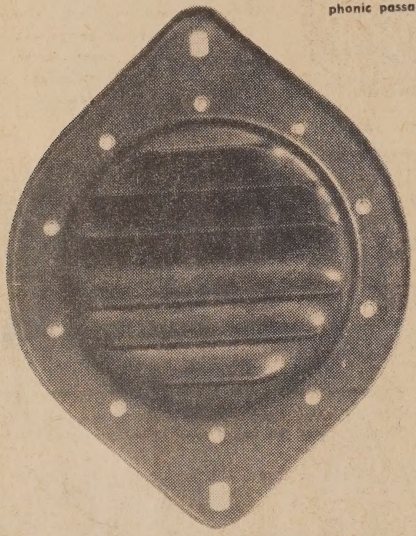
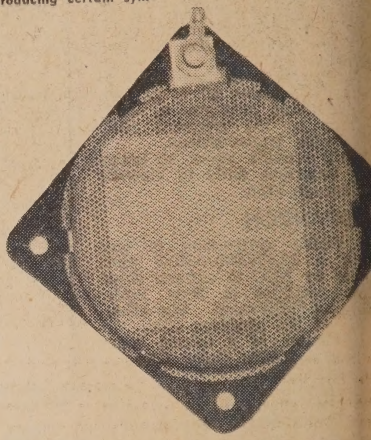
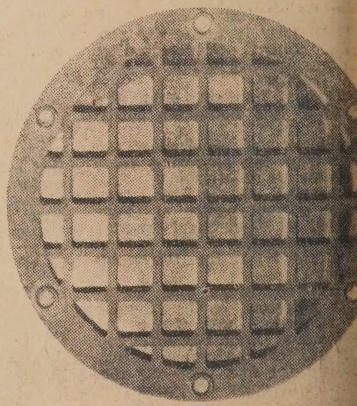


LORENZ Model LSH 100 (as illustrated) 7-18 Kcs Inherent capacity 1100 Pf. For outputs up to 20 watts. Size — 5in x 4in x ¾in. Price — **22/6 each**



LORENZ Model LSH 75 (as illustration) 7-18 Kcs. Inherent capacity 800 Pf. Polarising Voltage 300 v. AC Voltage 60 v: For outputs up to 6 watts. Size 3in x ¾in. Price — **12/6 each**

**INSTALLATION:** Electrostatic tweeters must be operated from a high impedance source, from the primary of the existing output transformer. They are not suitable for voice coil connection. It is very simple to fit an electrostatic tweeter to an existing receiver or amplifier, it merely entails the addition of resistors and capacitors and if required inductances. Circuits of suggested connections are supplied with each unit and appropriate circuit values given. The values in the circuits have been chosen to provide the necessary filter constants to prevent frequencies of the middle and lower registers reaching the electrostatic tweeter. When two or more electrostatic units are to be added they should be mounted as near to the loudspeaker as possible. Leads from the equipment to the electrostatic tweeter should be kept to the minimum length.



GRUNDIG Electrostatic Tweeter — Frequency response, etc., as above. Limited supply — Price — **£4/10/-**

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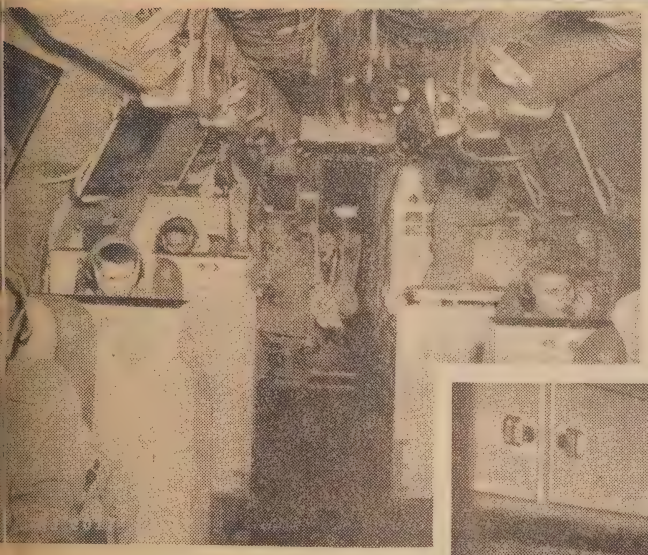
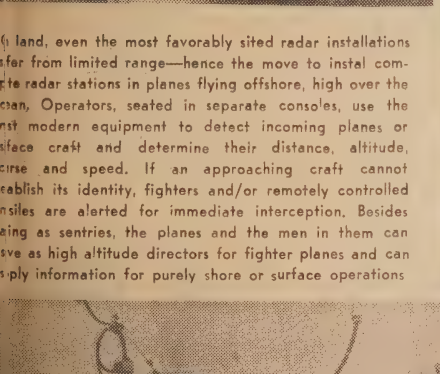
PHONE B

# LIFE ON A RADAR SENTRY PLANE



The huge "Constellation" is capable of a far longer sustained effort than the crew which mans it. They have to take time off every now and again to rest and "refuel". Here Lieutenant Commander F. D. Bryant, USN, draws a cup of coffee from the aircraft's compact galley, virtually the same as that found on standard intercontinental airliners. The galley unit is made of light stainless steel and aluminium. While the crews must be fed well, every pound saved in weight means that much more fuel and radar gear which can be packed in.



land, even the most favorably sited radar installations fer from limited range—hence the move to instal com- te radar stations in planes flying offshore, high over the ean, Operators, seated in separate consoles, use the st modern equipment to detect incoming planes or face craft and determine their distance, altitude, rse and speed. If an approaching craft cannot ablish its identity, fighters and/or remotely controlled siles are alerted for immediate interception. Besides ing as sentries, the planes and the men in them can ve as high altitude directors for fighter planes and can ply information for purely shore or surface operations

Air Force Master Sgt. William E. Lax (left) and Airman First Class John R. Pullen relax at a recreation table in the electronics sentry aircraft as others take over their duties. Carrying sufficient personnel for round-the-clock sky search, the big radar Super Constellation provides bunks and relaxation areas for men off duty. Favorite recreation pastimes a'oft are acey-deucey, scrabble, cribbage, reading mystery stories, plain-and-fancy talk . . . and consuming coffee.

# AEGIS-MULLARD "five-ten" AMPLIFIER

**Made in AUSTRALIA to suit Australian conditions!**

(Approved in every aspect by MULLARD-Australia Pty. Ltd.)

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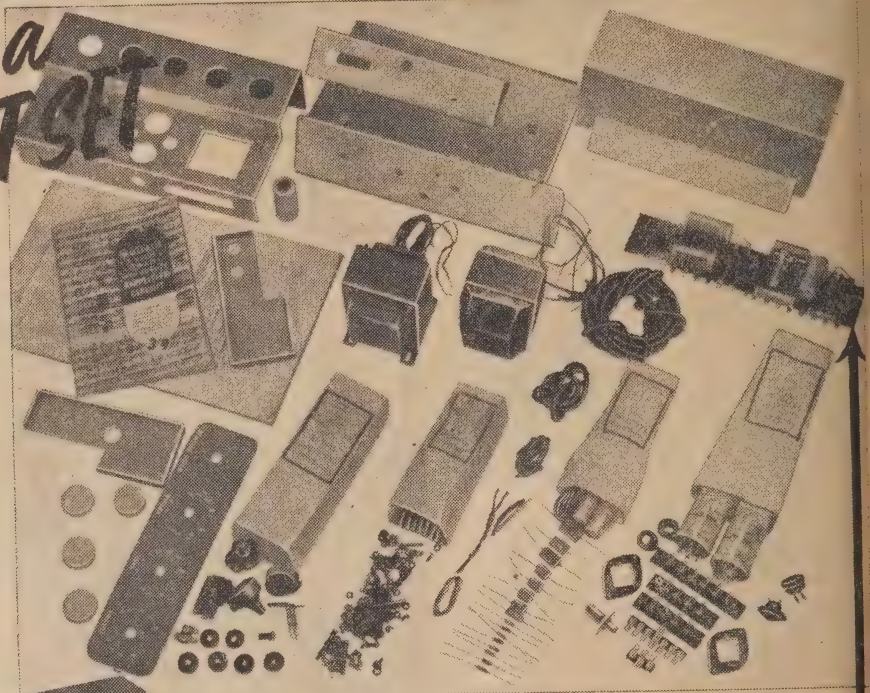

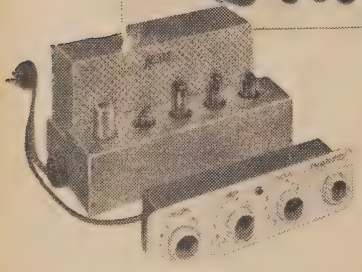

This is the completed amplifier. Can be purchased fully constructed with valves for £54/5/-.

*This unique AEGIS-Mullard Amplifier Kit includes a*

## PRE-FABRICATED WIRING STRIP

(Condensers, Resistors, Valve sockets, etc. all mounted and wired Thus, the most complicated part of the apparatus is ALREAD ASSEMBLED FOR YOU!

The Kit comes to you complete in every detail save for the valv These may be obtained separately if you wish. All other ancillia components are included plus full instructions and circuit.

Attractively boxed COMPLETE. Price (less valves) **£36/15**

Ask to see the AEGIS-Mullard 5-10 Kit at your nearest Aegis Deal If you experience any difficulty, contact us or the Aegis Agent your State.

FOR TECHNICAL DATA, see page 44, Radio & Hobbies, Nov., 195

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# WATCH-DOGS OF THE ATOMIC AGE

**Every year that goes by sees an increase in the applications of radioactivity. With it comes the need to guard against dangerous but unsuspected radiation effects. Warning devices, which are currently in use, apply principles which range from the very old to the very new.**

A Geiger counter made up to wear around the neck. It weighs about three pounds and operates from a coup'e of torch batteries. The meter pointer indicates a green, a yellow or a red portion of the scale, according to the amount of radiation present at any time.

☆

'HE discovery of perhaps the simplest of all radiation indicars was the result of an accident, as as the discovery of the special proerties of uranium. It proceeded from irly work with phosphors.

In 1896 Henri Becquerel, using his ewly invented phosphoroscope, was xperimenting with uranium comounds. He found that these produced yellowish-green phosphorescence ter exposure to ordinary light or ter exposure to the recently disvered x-rays.

Since the glow could be photoaphed, it appeared that the glow oduced effects on a photographic lm similar to those of ordinary light.

Now Becquerel had placed some of e uranium substance in a drawer nich also held some photographic ates wrapped in the usual dark per wrappings. Some time later, nen the plates were developed, it as found that they had become gged.

## ECIAL TEST

Following up this discovery, Becerel took a photographic plate rapped in the usual opaque paper d placed on it a small piece of d. Above this latter he put crysls of the uranium compound that d not been exposed to light.

After several days he found that e plate had been affected except f the part covered by the lead. Clearly then the effect was not due phosphorescence, but to a new roperty of uranium.

The penetrating rays that were able pass through thick paper and n glass, were called Becquerel ys, and this discovery was the beginning of the study of radioactivity.

All radioactive substances emit ys that affect a photographic plate, using it to appear dark after it has en developed in the ordinary way. Te more intense the source and the longer the exposure, the greater is the effect.

In hospitals and laboratories where radioactive substances are used, the nurses, doctors and workers wear a small piece of photographic film attached to the dress or coat. It is protected from the effects of ordinary light by a thin aluminium foil, but the Becquerel rays are able to pass through the foil and produce their effect upon the film.

At regular intervals the films are developed and, from their appearance, it can be found if the wearer has been exposed to a larger dose of irradiation than is considered safe. The necessary precautions can then be taken.

In the case of hospital patients, these precautions are unnecessary, because their radiation doses are carefully regulated. This inconspicuous film is now widely used as a "watch-dog".

Yet another modern "watch-dog" is of rather ancient origin.

When two pieces of thin gold leaf are hanging side by side from a metal support, which is charged with electricity, they quickly acquire equal and similar charges and hence they diverge.

So long as the charge remains on the leaves the divergence persists, but if the charge leaks away the leaves slowly come together again.

Now the radiations from radioactive substances placed near the leaves cause a change in the air between the leaves that promotes a leaking away of the charge. The more intense the radiation the faster do the leaves come together.

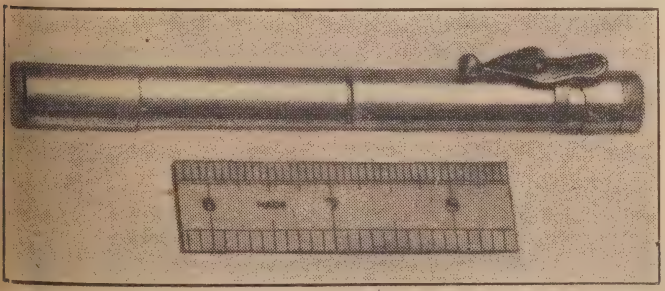
## USEFUL PRINCIPLE

It can thus be seen that this could be a most important tool for use in those situations where both an indication and a measure of the radiation is required.

The equivalent is called an electroscope instrument and in the form described is convenient only for laboratory use, because it is not portable. But a modern version of this is the quartz fibre electroscope, which is housed in an aluminium tube about the size of a fountain pen.

It can be clipped to the pocket and serves much the same purpose as the photographic film, but it has the added advantage that the dosage can be read at any time by looking at the tiny scale through the lens at the end of the tube.

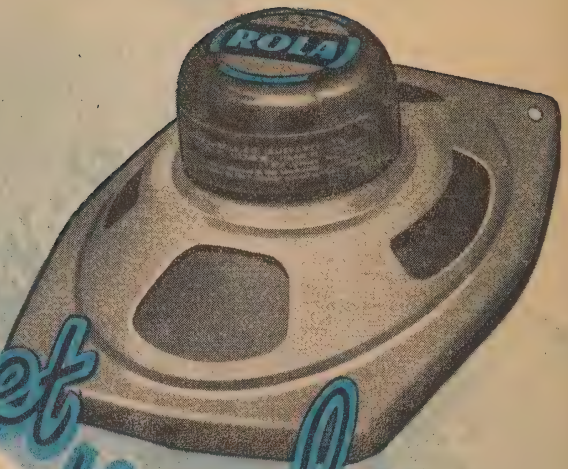
This is the latest of the watch-dogs that can inform us of the dosage



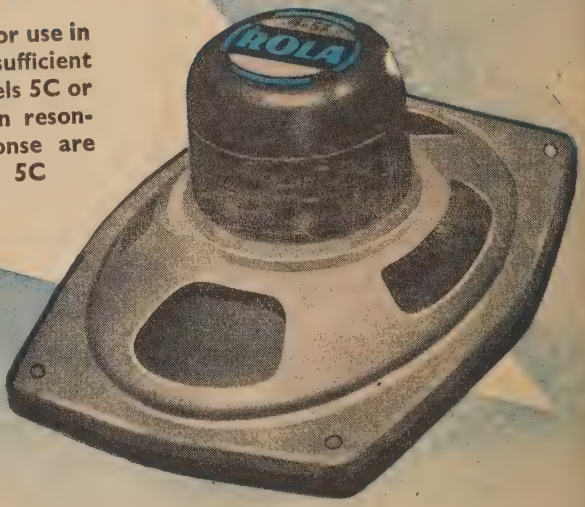
A fountain-pen radiation monitor, which fits snugly into the pocket. It applies the principle of the ancient electroscope.

**(Continued on page 15)**

# New Midget Ellipticals




**Models 4-5C and 4-5F are for use in midget receivers where insufficient height is available for Models 5C or 5F. Their cone area, main resonance and frequency response are similar to that of Model 5C with an F87 cone.**




ROLA COMPANY (AUST.) PTY. LT

THE BOULEVARD, RICHMOND, VIC. JB 3921. 116 CLARENCE STREET, SYDNEY, N.S.W. BX

# ATCH-DOGS OF ATOMIC AGE

(Continued from Page 13)

eived of these invisible rays, that y affect us without our being aware it. It is the one recommended for in Civil Defence.

But the most important and most erally useful of all the watch-s of radioactivity is the Geiger nter. This was invented by Hans ger, one of Lord Rutherford's as-ants. As the illustration shows, it sists of a short metal cylinder t is evacuated and has a thin mica dow at the end. A wire running n the middle of the tube is main-ed at a high electric potential. When a particle shot off from a dioactive substance enters the tube causes a minute and momentary of current. This can be ampli-by the use of radio valves and clicks of current can be made ible in earphones.

is even possible to magnify the ect so that the current will work a nting device.

he Geiger counter is a portable in-ment which can conveniently be si on patients in hospital, in re-ch laboratories and even in mines re men are prospecting.

or most modern requirements the rument is provided with a gradu-dial, and a needle moving over indicates the presence and the unt of the radiation.

is the instrument used to locate dioactive tracer elements, for scan-ing areas where radioactivity is sus-ed, and on a number of occasions proved the only means available finding radium tubes that have n mislaid.

he most sensitive instrument for ecting gamma rays is the scintil-tion counter. In this instrument the ation is allowed to fall upon a hosphor which then emits flashes light.

hese flashes are guided on to the -sensitive cathode of a photo-ultiplier. The latter converts the es into electronic pulses and amplifies them so that output es of one volt are readily attain-

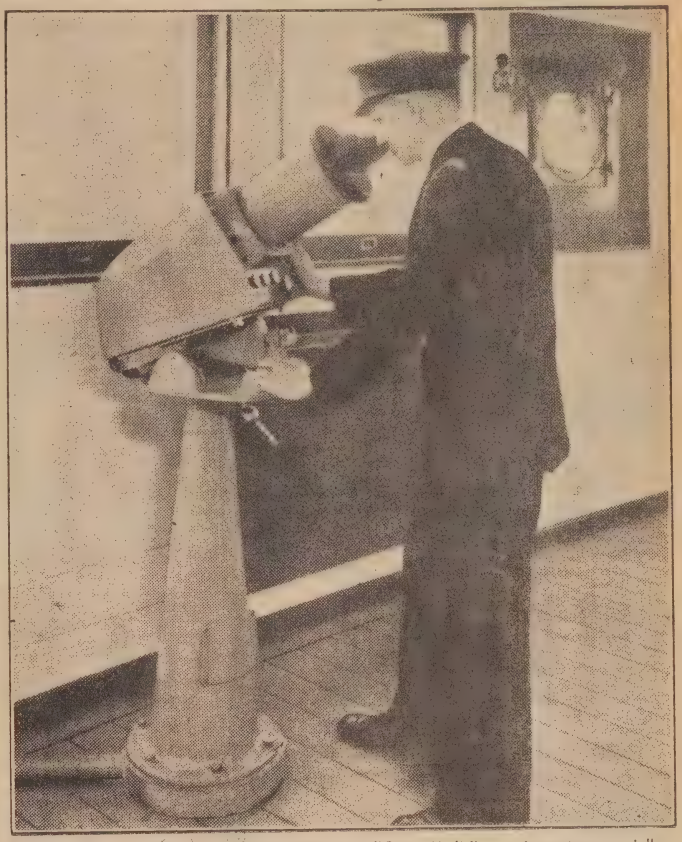
he instrument has been success-ly used in monitoring the thick-s of strip and the rate of flow lood through arteries.

# RECORD BY CANBERRA

An Australian-built Canberra jet bomber from the RAAF's No. 82 Bomber Wing at Amberley, passed over the Control Tower at Eagle Farm, Brisbane, at 11.59 am recently and was clocked over the Laverton Reserve, near Melbourne, 1 hour 36¼ minutes later. This is an official record for a Brisbane-Melbourne flight. The 865 mile flight made by this Canberra was so accurately estimated that the fuel consumption was within 10 gallons of the estimated amount, though the Canberra consumes something like 900 gallons an hour. The flight was made at 40,000 feet under very bad weather conditions. The aircraft took off in heavy rain from Amberley and, unlike a civil airliner, flew right through the bad weather, experiencing very bad turbulence. The RAAF's bombers must be able to operate under the worst weather conditions.

# NEW, COMPACT MARINE RADAR

**Constant refinement and development have greatly reduced the cost, space requirements, and weight of marine radar equipment, without greatly reducing its potential performance. The increasing use of navigational radar has created the need for a more compact, cheaper, marine radar set but which would retain the essential features and performance of larger sets.**



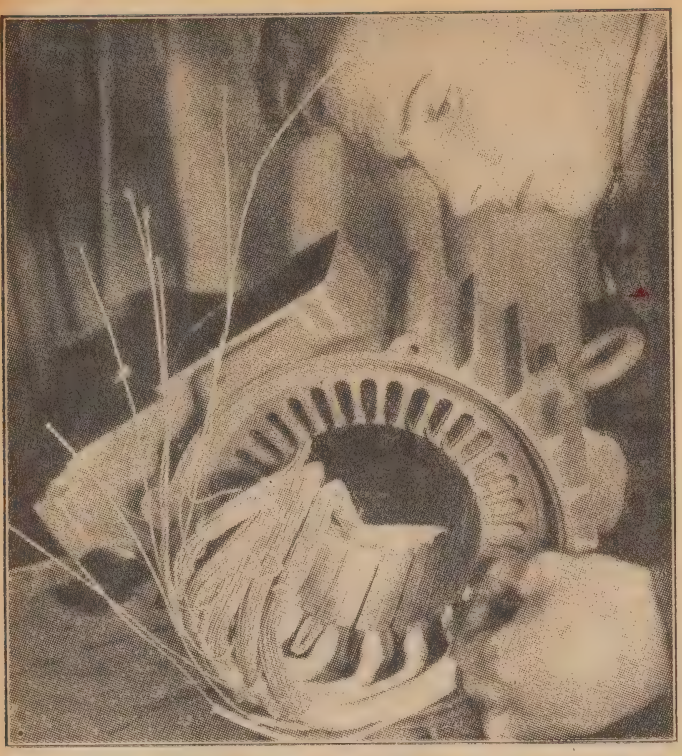
Illustrated above is the new Marconi "Quo Vadis" equipment especially designed for applications where simplicity and economy are of paramount importance. The transmitter can be housed either in a pedestal below the scanner or completely below deck, a waveguide being used in the latter case to convey energy to the aerial scanner.

The dispay unit provides five ranges, covering radial distances of 0.6, 1.2, 3, 10 and 30 miles. Another version provides ranges of 1, 3, 10, 20 and 40 miles. The length of the pulse is automatically varied with the range between the limits of 0.1 microsecond for the shorter ranges to 1.0 microsecond for longer range. This ensures good definition at short range and, alternatively, best use of the available power over greater distances.

The display unit employs only twelve valves, including the 6-inch P.P.I. display tube. This latter is viewed through a magnifying lens, which increases its effective area, and the hood aperture is so shaped that the display can be viewed in comfort by two people simultaneously.

For scanning, a new parabolic type off-set aerial is used, the design of the system eliminating the need for de-icing. Operational controls include a tuning adjustment, gain, sea clutter, rain clutter, P.P.I. brilliance, bearing scale illumination, bearing cursor rotation and range rings. An expanded centre device operates on the 0.6 and 1.2 mile ranges.

The "Quo Vadis" is supplied with all necessary test equipment and a full complement of spares, and provided with comprehensive metering facilites which give it the same reliability as larger units.



Rewinding a motor using silicone insulation. Apart from good electrical properties, silicone type insulation has very high heat resistance. Continuous ratings run to at least 180deg. Centigrade with a tolerance to temperatures as high as 250degs.

# SILICONES MAKE LIFE EASIE

**Most of us have heard reference, at various times, to certain remarkable chemicals known a Silicones. But do you know what a silicone is? If you don't, then read what Calvin Walter has to say on the subject.**

by Calvin Walters

IT is only within recent years that the properties of the silicones have been applied, although experiments with silicone have been carried out since about 1840.

Silicon is the most plentiful substance in the earth's crust. It is never found in the natural state but only in combination. Nearly all of the silicon in the earth is bound up with oxygen in the form of silicon dioxide or silica. Ordinary white sand has silicon as its main constituent.

The compounds of silicon are the most durable materials known to man. They include quartz and sand, mica, asbestos and glass.

All these materials are highly resistant to heat and oxidation. They are also remarkably resistant to attack by chemicals.

The true nature of silicon was unknown for thousands of years, and it was not until 1824 that this element was isolated by Johann Berzelius. He later discovered that the element could be combined with chlorine to make silicon tetrachloride, the basic material from which silicones are made today.

However, many important properties of silicone escaped the attention of the early investigators, although practically all of them realised that silicon was capable of many unique reactions with other chemicals. By treating it with ammonia, chlorine, alcohol, calcium, hydrogen and many other chemicals, silicon gave peculiar and unexpected compounds.

Many of these compounds are today used as basic materials for the manufacture of our commercial si cones.

Most of these investigators notic a similarity in the chemistry of ca bon and silicon, and carried o experiments to determine the rel tionship, if any, between the tw elements.

It was left to Professor F. S. Ki ping, of the University of Nottin ham, in England, to carry out monumental work extending fro 1899 to 1944. During this perio Kipping published 54 papers on t subject of silicon, and his research are the basis of practically all o present knowledge of organosilic compounds.

These compounds are combin tions of the element silicon w organic materials containing carbo

## CARBON-BASED CHEMICALS

Kipping found that carbon has property of joining with itself a other atoms to form new molecu The varieties are endless, over h a million carbon-based chemic being known at the present time.

During his experiments, Kipp became worried by the appeara of what he called oils and glues the mixtures with which he v experimenting.

Little did he realise that th self-same oils and glues are the cones now used in a variety ways.

The main consideration was to attach organic groups of chem to silicon. That the resul chemical retained all the prope of silicon such as heat-resista resistance to chemical attack moisture, bore no significance Kipping.

Without going further into history of the chemistry of sil we may state generally that Kip discovered a method of attachin ganic groups of molecules to the ment silicon. This has resulte industry today securing a rang remarkable chemicals which a to help make life a bit easier, for the manufacturer and the of his products.

Now I don't want to frighten to another article in this issue cause you think I'm getting too nical, but there are a few thing garding the chemistry of sil

ch will help in understanding the ter. First of all a few terms monly used:

e have already learned what anosilicon means.

ARBON CONTAINING GROUPS: roup of atoms containing carbon as methyl, ethyl or phenyl, ible of uniting with some other n or group.

NTERMEDIATES: A compound aining an essential grouping ch, by further processing, is con-ed to the finished product. In case, an organosilicon compound imple structure used in the pre-ation of organosilicon polymers.

OLYMERS: A chemical com-nd in which some simple group cture is repeated throughout the ecule such as silicon-carbon-sili-carbon, and so on.

YNTHESIS: A process which orked out to bring about a desir-result by chemical means as dis-uished from naturally occurring.

we find that the preparation of mercial silicones involves a Syn-is of Intermediates followed by merisation to form the required lucts or, to put it more simply, a ufacture by chemical means nthesis) of a basic compound ermediate) which, by further essing, alters the structure by the tion of groups of other atoms — our case, carbon — (polymerisa-) and the resulting chemical is a YMER.

## OCESSING SILICON

is sufficient to say here that the n intermediate used is Silicon achloride.

licon is first made by heating l and coke to a temperature of degrees Centigrade. The silica id) loses its oxygen and elemen-silicon is obtained.

hen this is treated with chlor-silicon tetrachloride is obtained. chemical is the starting point a whole series of chemical tions.

y further chemical treatment nic (carbon) groups are added that different arrangements of e groups with the original sili-atom brings about different results. In fact, the reaction can be controlled so that a compound can be made for almost any specific purpose. These compounds are called SILICONES.

Some silicones are fluids, some are resins and others are oils or rubbers.

Needless to say, the vast resources of the world's largest chemical companies have been devoted to the study and production of commercial silicones.

The Dow Corning Corporation of America, the General Electric Corporation Silicone Dept. and the Imperial Chemical Industries Ltd., are three of the main manufacturers. I am indebted to the latter for some of the data given here.

Commercial silicone products have as their main attributes, the property of stability at low or very high temperatures, high water repellency, good electrical insulation, resistance to chemical attack.

There are five main types of silicones, namely fluids, compounds, lubricants, resins and rubbers.

The silicone fluids have a wide application in industry. Because of their excellent electrical properties they are used as liquid insulators. Further, because of the great stability, high ignition temperature, high resistance to mechanical breakdown and small change in viscosity with temperature, they are used in hydraulic systems.

By mixing small amounts of finely divided silica with the fluid, a wax-like compound is formulated which is used as a lubricant for valves, for impregnating pump packing under high temperature and corrosive conditions, and so on.

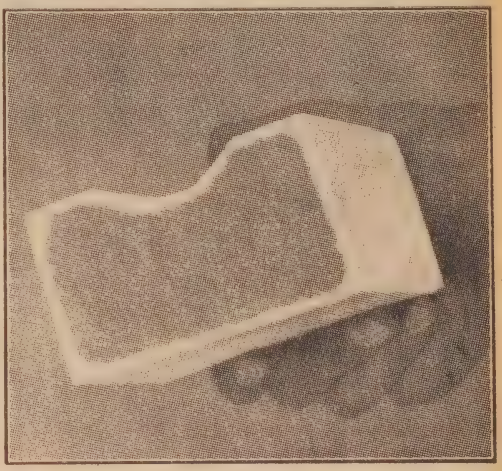
Greases are prepared by mixing the fluid with carbon black or special soap.

## PERMANENT LUBRICANT

The greases are used as a "lifetime" lubricant in sealed bearings.

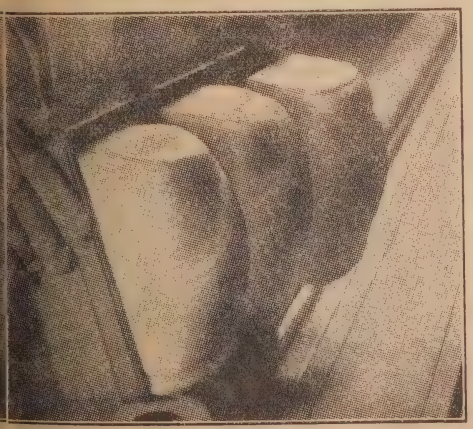
Resins are used in electrical insulations, in the preparation of laminated materials, as release agents in moulds, &c., and as water repellents.

Silicone rubbers are used where heat resistance is required. They withstand temperatures and retain their resiliency at from minus 85 degrees Centigrade up to 250 de-

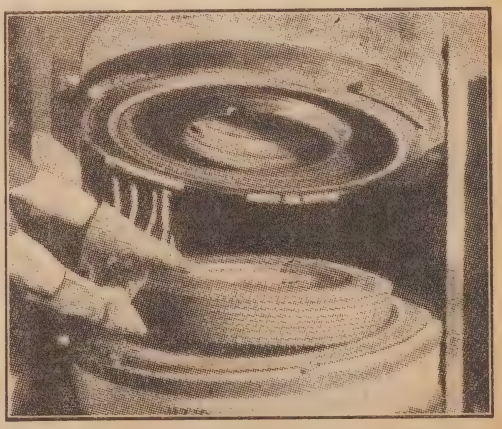


Section view of a house brick, specially photographed to show the surface penetration of silicone resin. The coating can be applied to brick, stone, mortar, concrete or plaster, by either brushing or spraying. It is invisible, repels surface water but does not seal the pores. Treated surfaces can be painted later, if desired.

(Photographs by courtesy of Imperial Chemical Industries Ltd.)



aves fall out easily and baking pans remain clean when the latter are treated with silicone.



Tyres can easily be removed from treated moulds. Heat does not prejudice effectiveness of the treatment.

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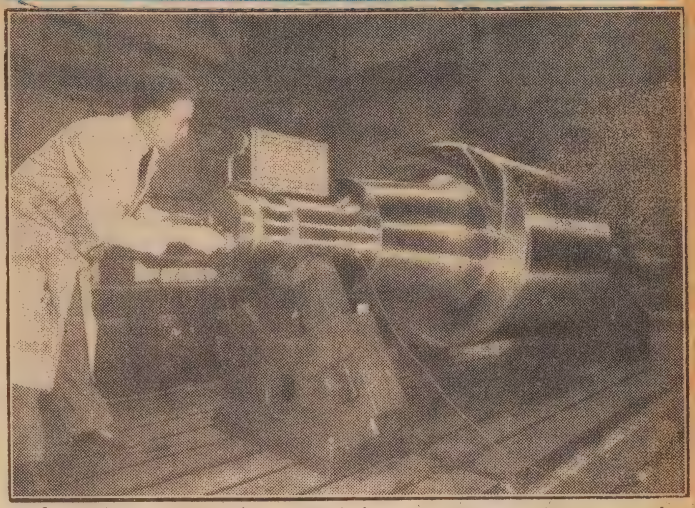

Supersonic energy is used in a British factory to examine a huge casting for internal flaws. Cracks in the casting affect the pattern seen on the oscilloscope screen and thereby reveal their presence to the operator.

ees Centigrade. They are used r mechanical seals such as refrig- ator doors and so on.

The outstanding water repellent operties of the silicones make them itable for many purposes. A di- te solution of the resin is brushed to masonry and brickwork. The lution penetrates the material and aves a water repellant coating ithout forming a sealing skin. The visible silicone coating still al- ws the masonry to breathe, thus oviding the means for the drying t of water vapor.

On textiles, silicones provide an cellent waterproofing invisible ating. The silicone readily pene- ates the cloth so that each individ- l fibre is coated with a water re- llent finish. This is particularly on synthetic fibres such as rayon, lon, nylon, &c.

The advantage of the silicone treat- ent is that the fabric remains per- eable to air, water vapor passes ely through the fabric and inter- l condensation is eliminated.

## LEANING GLASSES

One of the familiar uses of the icone fluid is in the impregnated sues used for cleaning spectacles. ese are little books of tissues im- egnated with silicone fluid. The icone is deposited on the spectacle nses in an almost immeasurable m and provides a brilliant surface om which grime and dust are easily moved.

A more recent application is the mpregnation of flannel cloth with icone fluid as a cleaner for bowls. e cloth deposits a thin film over e bowl, which lasts for many onths and prevents the accumula- on of moisture or the collection of ime from a damp bowling green. The treatment is ideal for car ndows and windscreens.

Car polishes are now being manu- ctured with silicone fluid as the tive constituent. It takes about e-quarter of the time to polish a r with this polish than with the nventional wax polish. Water ows from a car polished with a icone polish like water from a uck's back.

One word of warning is necessary. you have to repaint your car at y time and you have been using icone polish, don't forget to tell e painter. Special methods have to be used to get rid of the silicone m, otherwise the painting job will t be successful.

In the moulding of plastics and bber goods, difficulty is often ex- rienced in releasing the moulding om the mould. Silicone fluids have tstanding anti-sticking properties.

## ELEASE AGENT

They are, therefore, ideal as a re- ase agent for coating the inside of e mould. They will withstand high mperatures for a much longer riod than other agents and do not ild up in the mould.

One resin manufactured by Im- rial Chemical Industries is of very eat importance to the baking trade, r glazing the inside of bread baking ns.

The ordinary method of coating e inside of the pans allows only out 20 loaves to be baked before e pan requires cleaning. Burnt ugh builds up and chars on the in- side of the pan, making cleaning and scraping necessary after every 20 bakes. A coating of the special silicone resin allows as many as 2000 loaves to be baked in the tin before retreatment is required. This reduces the cost of the loaves to the baker. What its does for the consumer is another matter!

If an aluminium ice cube container in the refrigerator is coated with a silicone preparation, the ice cubes readily fall out into the whisky or what have you. There is no need to bash in the bottom of the container or the corner of the sink in order to remove the cubes.

Silicone-treated paper is used to place between materials which would otherwise stick together, such as self-adhesive tape.

## WOULDN'T STICK

I have been assured that the gum on some envelopes I purchased recently were not treated with silicone. That being so, just what did they put into the gum to prevent it sticking?

Another recent interesting application of silicone is the addition of about ten parts of silicone fluid per million parts of paint. This is highly effective in preventing the formation of "orange peel", "silking" and pigment flotation. Di-methyl silicone fluid is used for this purpose. This kind of paint has excellent gloss retention properties. The amount of silicone required is very critical. Too much can be as bad as too little.

Silicones are used to prevent the formation of foam in the mixing of fluids. One to 20 parts per million is satisfactory for the prevention of foam in paint, varnish, textile and dyeing processes. It can even be added to beer but, judging by the amount of "head" on the average middy, it is not used to any extent, if at all.

The use of silicones in the pharmaceutical and medical professions is still in the process of experiment and development. However, they have been used successfully in face creams and barrier creams. The water repellent action of the silicones protects the skin against moisture.

It has also been found that silicones can, in some cases, effect a cure for certain forms of dermatitis.

Silicone treatment of syringes and needles helps to prevent blockages during blood transfusions. Measuring instruments treated with silicone are not wetted by liquids. Thus they empty rapidly and waste is eliminated. This also makes for more accurate dispensing.

## FOR SURGERY

One interesting application in surgery is the use of silicone rubber to replace diseased vessels and organs in the human body. This rubber has proved non-toxic and inert to the chemical processes inside the body.

Instruments sterilised in silicone oil, which has a long life and can be used at very high temperatures, retain a film of the oil, which lubricates and is non-corrosive.

Silicones are available in the form of pastes. These are used for sealing, caulking and coating. They possess all the properties of the other silicones. In hospitals, sheeting has been coated with silicone rubber paste. The sheets can be sterilised repeatedly without becoming hard. The pastes can be coated on ceramic ware to give a durable, adhesive, electrically insulated coating.

Silicone-treated high-tension insulators are greatly improved, inasmuch that they do not collect dust or moisture as readily as untreated insulators, thus minimising short circuits or leakage.

Space does not permit further examples of the uses of these most important products. However, readers can readily imagine a multitude of uses when the main characteristics of silicones are brought to mind.

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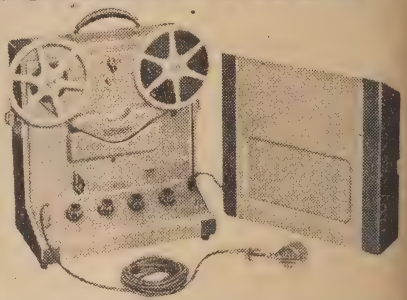

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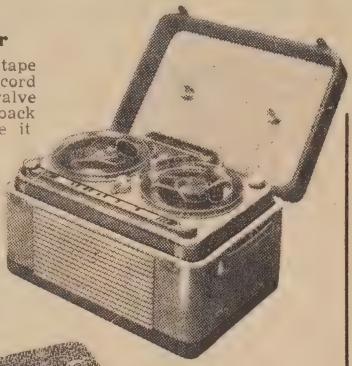

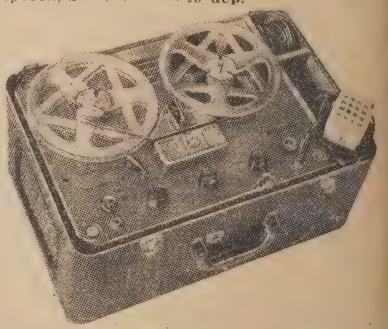

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# Technical Review

## BASIC SYSTEMS FOR RADAR GUIDED MISSILES

**Guided missiles are in the news and a timely article in the February issue of Wireless World reviews a number of the basic control systems at present in operation. Security prevents the release of vital details but this summary gives an excellent idea of the problems encountered and, broadly, how they are tackled.**

GUIDING a missile toward an air-borne target can be considered in one sense as a navigational pro-blem in which continuous measure-ments are made of the relative posi-tions of the missile and target and the resultant information is used for automatically steering the missile.

In another sense the operation can be regarded in the light of a closed-loop servo system, where the mech-anism works to reduce an error-signal (distance between missile and target) to zero.

However one looks at it, the busi-ness demands some method of meas-uring the relative positions of the missile and target in space and, of course, one of the most potent means of doing this is by radar.

Three main methods by which radar can be used for missile guid-ance were described recently by W. H. Stephens, head of the Guided

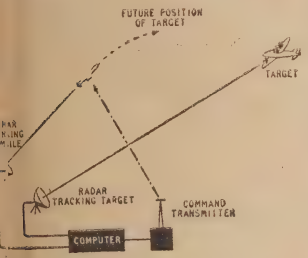


Fig. 1 Essential features of the "command guidance" system. Note the twin radar units, one for the target, and one for the missile.

Weapons Department of the Royal Aircraft Establishment at Farnborough.

In the first method, known as "command guidance," there are two ground radar sets, one of which automatically tracks the target and the other the missile (see Fig. 1). The information on range, bearing and height from each set is passed to a computer, which calculates the control movements necessary to steer the missile toward the future position of the target. Signals repre-senting these control movements are then transmitted by radio to the missile, which behaves accordingly.

A great advantage of the command guidance system is that most of the electronic equipment is concentrated on the ground.

Another system described by Mr Stephens requires more apparatus in the missile but perhaps offers a greater chance of successfully inter-cepting the target. This is called "semi-active homing" (see Fig. 2).

Here there is a single radar set on the ground tracking the target and continuously "illuminating" it with electromagnetic radiation.

### AUTOMATIC HOMING

The energy reflected by the target is picked up by a directional para-bolic aerial in the nose of the missile itself, and, according to the direction from which the radiation is coming, the aerodynamic control surfaces are moved so that the missile automatic-ally homes on the source — that is, the target.

The homing system, however, does not keep the missile continuously pointing at the target during its flight. If it did, such a violent slew-round toward the moving target would be necessary at the end of the interception that the missile would be incapable of providing the re-quired lateral acceleration and would go wide.

The control system is therefore arranged to steer toward the future position of the target by a method known as "proportional navigation".

There is a slightly different kind of homing system in which the missile carries its own radar trans-mitter (known as "active homing") but this, of course, adds considerably to the weight and complication of the airborne equipment.

The third method of guidance described by Mr. Stephens is called "beam riding" and the principle here is that the missile is guided up the beam of a radar set which is auto-matically tracking the target (see Fig. 3). Alternatively the beam may be produced by a separate trans-

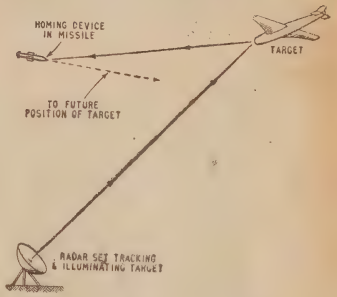


Fig. 2 The "semi-active homing" system. Radar impulses reflected from target are received directly by missile.

mitter whose aerial position in azimuth and elevation is automatic-ally controlled by the radar set.

The airborne electronic equipment continuously measures the deviation of the missile from the centre-line of this beam and applies appropriate surfaces to keep the missile flying as close to he line as possible.

The measurement is achieved by virtue of the fact that the beam has minimum field strength in the centre, increasing toward the out-side, and changes in position of the missile inside it produce correspond-ing changes of signal strength in an aerial system.

A wider beam of the same kind is used to "gather up" the missile in the initial stages of launching and guide it toward the main beam. To fire the missile straight into the very narrow main beam would, of course, be extremely difficult.

It appears that the "beam riding" system is used quite extensively for guidance purposes and this may be because it has the important practical advantage of allowing a whole series of missiles to be sent up the same beam.

### WIDENING OF BEAM

Unfortunately it becomes less and less accurate with increasing range because of the widening of the beam, so it is sometimes necessary to use a homing device in the missile to take over in the last stages of the interception.

Mr. Stephens did not enter into details of the actual equipments used for control, but nevertheless a cer-tain amount of information has be-come available from other sources.

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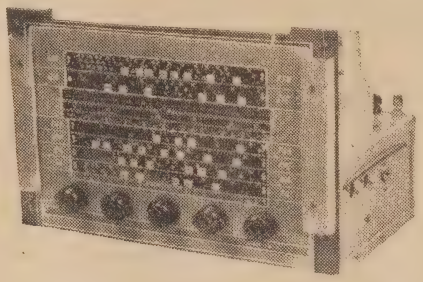

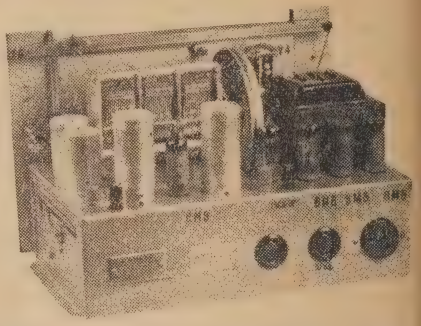

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xample, there is the technique
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ade automatically to track the
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accepted way of doing this is
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dar beam so that it continually
out a narrow cone in the sky.
lly an electric motor drives
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r, or possibly the whole para-
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he cone is exactly centred on
rget the energy reflected back
e radar receiver will be the
for all angular positions of the
during its rotation and the
strength will be constant.
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from the centre toward one
of the cone, however, the re-
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e beam moves away.
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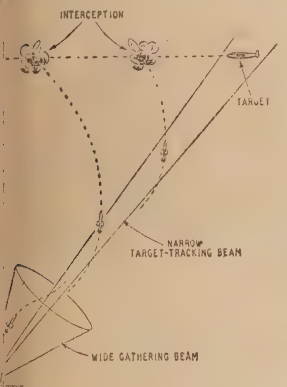
speed of the beam, and the




3 The beam riding system which
mits several missiles to be launched
the one beam. Note the wide and
narrow beams.

gth of the fluctuations, or am-
ie modulation of the signal, be-
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t has moved off centre. This
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oment of homing missiles (fig.
nd here the positional informa-
t from the aerial is used for
ating the missile itself.

## NICAL SCAN

e conical scan again figures as
important part of the beam-
g control system (Fig. 3), for
iding a "beam" (really a scan)
low field strength in the centre,
easing toward the outside.
re the missile usually has four
l elements arranged at 90 de-
intervals around its cylindrical
(sometimes built into the trail-

ing edges of the cruciform wing structure), and deviations of the missile from the centre of the cone produce the disproportionate signals in these elements.

The relative strengths of the signals give the position of the missile relative to the cone-centre in polar co-ordinates (radius and angle) and these values, after transformation into Cartesian co-ordinates, are used to apply the necessary correcting movements to the control surfaces

Different radio frequencies are used for the two conical scans in Fig. 3, and in the missile these are separated to give two sources of signals. An automatic switching device then transfers the control from the wide scan to the narrow scan at the appropriate moment during the flight. The wide scan might have an angular width of about 26 degrees and the narrow scan a width of about 3 degrees.

## MANY SIDE-EFFECTS

In all guidance systems, of course, there are a good many side-effects which have to be allowed for if the interception is to be completely successful. Some of these are exemplified in the control equipment of a beam-riding missile produced by Oerlikon in Switzerland for anti-aircraft defence.

This weapon (Fig. 4) is about 20ft long and 16in in diameter, and can be steered to a height of nearly 50,000ft. It has cruciform wings which can be moved backward and forward to compensate for changes in weight, lift and centre of gravity during flight, while the steering is done by deflecting the propelling nozzle and a cruciform set of fins at the rear.

The control equipment on the ground takes the form of three wheeled vehicles — a radar set for tracking the target, a separate beam transmitter and a computer van (Fig. 5).

One of the spurious effects which have to be corrected is the the undesired displacement of the missile from the centre of the beam which must occur when the beam is moving, and a computer is necessary to compensate for this. Another computing device is used for limiting the speed of movement of the beam-transmitter aerial so that there is no danger of losing control by swinging the beam too quickly for the missile to follow.

## PARALLAX PROBLEMS

Then there are problems resulting from the parallax phenomenon. In anti-aircraft operations the missile battery would be warned of the approach of hostile aircraft by a distant radar and the local radar set there would be a parallax error in the information, so again a computing device is necessary for correction purposes.

The same sort of parallax error also occurs between the local radar set and the beam transmitter controlled by it, and another correcting device is used here in the automatic positional control system which links the two equipments.

In the missile itself, errors in the guidance signals could be introduced by the missile "rolling," or rotating about its longitudinal axis in flight, for this would upset the angular positions of the aerial elements relative to the "beam."

The trouble is overcome not by preventing the missile from rolling but by transforming the information in the missile's position from space co-ordinates into co-ordinates relative to the missile itself.

A gyroscope is used in the transformation computer, and the result is that the millie's response to guidance signals becomes independent of its angular position. Another gyroscope is incorporated for controlling "pitch" and "yaw" movements.

The steering-fin deflections of the Oerlikon missile are made by an electro-hydraulic servo-mechanism, and this system is, in fact, common to a great many types of guided weapons. Usually the guidance signals are amplified by a power amplifier and then used to operate mechanical valves which control the flow of hydraulic fluid into small jacks driving the fins.

## FEEDBACK INFORMATION

The servo loop is closed by a feedback circuit which sends positional information from the fins back to the electronic servo amplifier.

Very little is known about the actual electronic circuitry used in missile control systems, but the form of construction is generally based on printed or potted circuits with wired-in miniature or subminiature valves.

The valves in particular have to be "special-purpose" types capable of withstanding the effects of shock, vibration and acceleration, and the

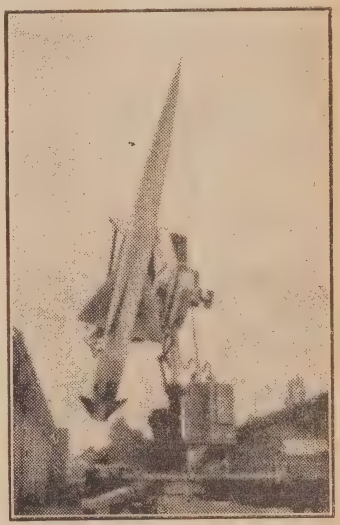

Fig. 4 A typical beam riding missile on its launching ramp.

equipment as a whole must be designed for working under high-temperature conditions.

Many of the developments in valves, components and sub-assemblies which have been reported over the past few years have, in fact, been stimulated by the special demands of guided-missile work, and even if this work is never used for its intended purpose (which is to be hoped) it certainly will not have been wasted.

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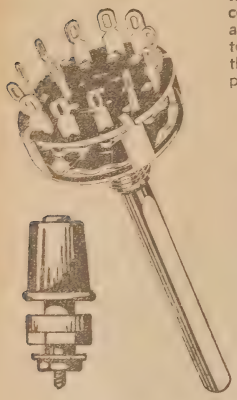
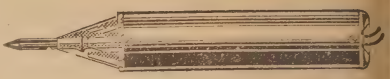
# *Fine* RADIO COMPONENTS

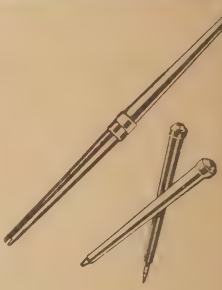


**Rotary Wafer Switch.** A single bank unit of compact design. Diameter only 1¼" (size of a penny), depth 7/8". Single pole type, up to 12 positions; two pole to 6 positions; three pole to 2 and 3 positions; and four pole to 2 and 3 positions.



**Probe Housing.** Chrome-plated brass tube with clear polystyrene mouldings. Internal size, 7/8" x 4".

**Insulated Spring Terminal.** Fully insulated from chassis, nickel-plated brass post, moulded polystyrene body. Made in six brilliant colours—red, black, light and dark blue, green and yellow.

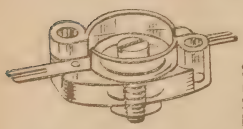


**Aligning Tool.** A dual-purpose tool with screwdriver tip for standard I.F. transformers. Reverse end has recessed slot. Nickel-plated brass fittings moulded into polystyrene.

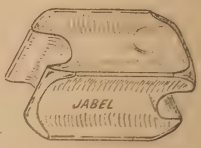
**Test Prods.** In red and black polystyrene, plated brass tips, ample lead space.

**Junior Trimming Condenser.** Non-hydroscopic compression moulded base, silver-plated phosphor bronze plate. Fine thread, giving smooth linear variation from 4 to 60 mmfd. The diameter of sixpence, and 1/8" thick—ideal for gang mounting.

**Planetary Vernier Drive.** 5 to 1 reduction (No. 1 illustrated). No. 2 has cursor mounting flange. Instrument log dial scale assembly also available.



**Standard Trimming Condenser.** A chassis mounting type in high impact polystyrene. Similar characteristics to Junior model. **Padding Condenser 455 kc also available.**

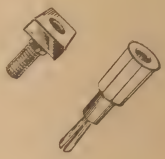


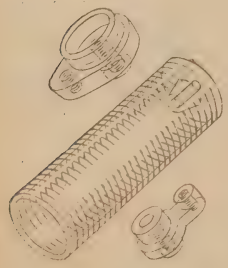

**Egg Insulator.** Polystyrene moulding—the lightest, strongest and best insulator procurable. Absolutely unbreakable.

**Trimming Condenser Blocks.** The Standard Trimmer is also available in blocks of four (illustrated on left), three and two units.

**Banana Plug.** N.P. brass split pin for positive contact. Solderless screwed type connection.

**Socket.** Insulated collar recessed for protection from "hot" circuit. Stepped for insulation from panel. Both available in red, black, green and yellow.





**Moulded Polystyrene Coil Former and Coil Mount Bases.** ¾" diameter formers, 2" long, grooved to 16 T.P.I. (or plain), one end open, other tapped 5/32" for mounting or core. Larger coil base fits either ¾" or ½" formers and is tapped for core and mounting. Small unit is for 3/8" formers, also tapped as above.

*Discriminating radio engineers, manufacturers and custom-des specialists choose JABEL Fine Radio Components because of their repu tion for consistent high quality and reliability which results from ma years of accumulated technical experience.*

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# SQUARE WAVES RECORDED ON DISC, PLAYED BACK

**espite recent emphasis on the square-wave test-g of amplifiers, certain awkward questions have emained unanswered: Does it mean anything n practice? What kind of a square-wave can be ecorded and reproduced on disc? How much nging does the record-replay process introduce anyhow?**

ow an answer to these questions orthcoming from a paper by C. Davis in the "Journal of Audio ineering Society"—USA.

presenting the paper, the or's chief object is to describe w disc recorder mechanism, pro-d by the Westrex Corporation, ywood, California.

he head itself has many interest-design features, including a sim-ed provision for stylus heating, se of a tapered-shank stylus and application of corrective feed-, originating in the stylus hanism, to achieve near-perfect rical damping.

hat is of immediate interest, ever, is the use of square waves emonstrate the capabilities of record head and, incidentally, of odern pickup.

is photographs of the recorded ks which, unfortunately, are not able for reproduction here, indi-quite clearly that a square input e produces a triangular track, ming normal recording tech-es.

## "ARGUMENT"

eaders may remember that this the point of much discussion e years back in the "Argument" mns, and the curves published Davis verify the conclusions there vn.

he point may be recalled by re-ng briefly to the accompanying ram.

hen the polarity of the input sig-(a) changes at the leading edge he first square wave, the driving e on the stylus changes direction the stylus does likewise (b).

uring the interval thereafter, n the input signal is held to a tant value, the stylus accelerates he new direction at a rate which overned by its mass and the driv-force applied to it.

t the end of the half cycle, the al voltage reverses in polarity, stylus halts abruptly and begins ccelerate in the opposite direc-

he net result is a track of triangu-waveform (b).

hen this groove is tracked by a city conscious pickup, each ipt change in direction is repro-ed as a transient, which becomes leading edge of the reproduced re wave.

s the playback stylus accelerates g the sides of the triangle at con-t velocity, it generates a constant age of appropriate polarity — and bottom of the square wave.

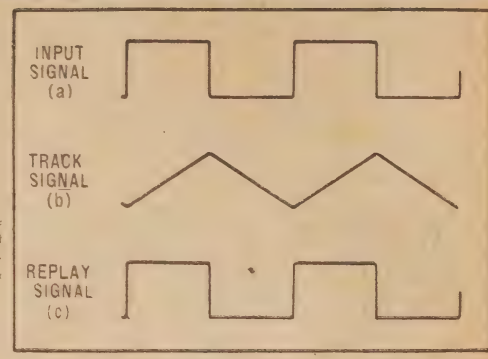
avis explains it this way:

When square waves are recorded a disc with constant velocity racteristic, they present the ap-rance of triangular or "zig-zag" erns.

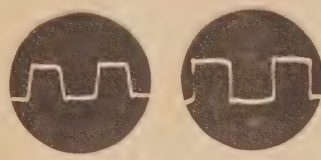
This shape results because the usual expression for square waves is integrated to the triangular form by the recording process. Conversely, the reproducing process converts them back to a square wave in reproduction.

"This latter effect may be visualised by the fact that the triangular grooves impart motion to the stylus with sudden changes in direction. Since constant stylus velocity generates constant reproducer voltage, the motion imparted to the reproducer generates alternate fixed voltages, hence the resulting square waves."

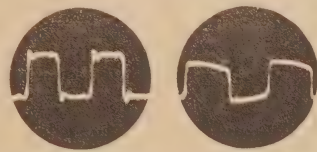
Recordings were made at high amplitude at 60 cps to better illustrate the interesting triangular waveform.




Illustrating the relationship between a square-wave input (a) and the resulting triangular track (b). Signal after replay is illustrated at (c).



Tracings of a 1 Kc (left) and 150-cycle (right) square wave, taken from the output of the record-head monitor.



On the left, 1 KC note recorded and replayed at 78 rpm, 11 in. diameter, on the right 150 cps recorded and replayed at 33 rpm, 9 in. diameter.

On the left, 1 Kc note recorded at 78 rpm, replayed at 33 rpm, 11 in. diameter; on the right, 1 Kc note recorded and replayed at 33 rpm, 8 in. diameter.

"Incidentally, this track cannot be reproduced by standard reproducers, as they find difficulty in tracking triangular waves, even of much less amplitude. Possibly these waves may serve in testing the relative tracking abilities of reproducers.

"Square wave testing is becoming widely used in providing useful information, particularly in regard to devices which may overshoot or "ring" when subjected to a sudden input voltage. This applies to mechanical as well as electrical circuits.

"Square waves indicate the generation of distortion during transient operation, such as with program material, which may not be indicated by other means.

"The results of square wave input voltages into the disc system are shown in figure 7 under the conditions indicated therein.

"Reproduction from the record was made with a typical variable reluctance cartridge. For the purpose of these graphs, a small amount of low frequency boost was added to offset the generally preferred slightly drooping characteristic used in recording.

"Without this change, the existing phase shift at these frequencies caused a slight amount of tilt in the square waves."

## SUMMARY

The observed difference between the reproducing conditions at 1Kc may be due to dynamic changes in the reproducer, as well as to changes in high frequency response.

"The 150 cycle shows a slight excess of its fundamental frequency and its reproduction, in turn, shows a slight phase shift in the fundamental.

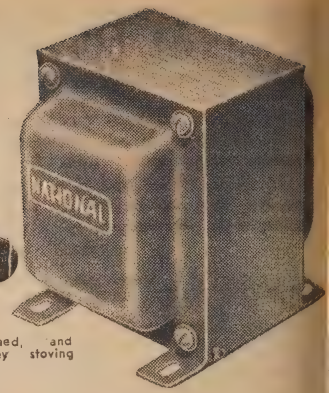
"It is apparent that the overall result is good in all cases and that the recorder and amplifier combination itself is capable of meeting very strict square wave requirements."

If additional comment is required to Davis' remarks, as quoted above, it could only be to emphasise that the overshoot and ringing revealed after playback is apparent, but not excessive.

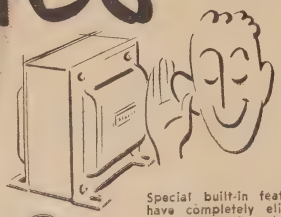
It is certainly of a lesser order than might be apparent in conventional feedback amplifiers, designed a few years ago.

**(Continued on Page 114)**

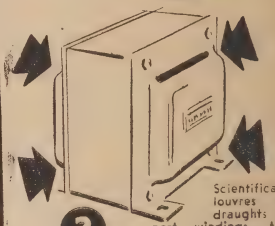
# essential features




1 Attractively finished, and coated with grey stoving enamel.

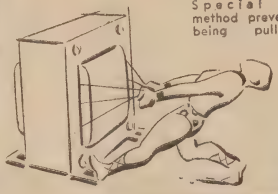


2 Special built-in features have completely eliminated lamination hum.



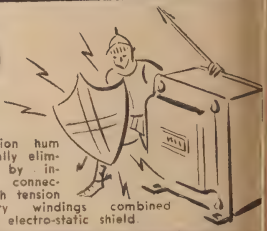
3 Scientifically plac louvres permit draughts of cool past windings, thus ensu lower working temperature added safety

Special anchoring method prevents leads being pulled out



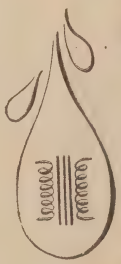
4

5



Modulation hum is virtually eliminated by inversely connective high tension secondary windings combined with an electro-static shield

6



Coil is impregnated with special varnish and baked to resist humidity.

7 Available in an unexcelled rang of upright and flat types betwee 40 and 250m. for both radio an step down application.

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# FROM THE EDITOR—OVERSEAS

From his hotel room in Paris, beside the historic Louvre, and the Garden of Tuileries, Editor John Moyle records his impressions of Switzerland and Germany. There is much more to report, he says, but it will have to wait till he has more time and a better opportunity to use his typewriter.

VERLAND from Milan to Berne, through the Simplon Tunnel — world's longest, which takes ut 25 minutes to negotiate—must ng an everlasting thrill to the most soned traveller, and a healthy re- ct for the engineering which pro- es electrical transport all the way. verhead gear, and diesel-electrics Italy, are almost the sole means power in Italy and Switzerland. until the German border is hed is steam used, by engines ed more for their performance their beauty.

## NTER BEAUTY

he heavy winter fall has left the s drenched in dazzling white. long fingers of snow reaching n into the valleys, and ice-sod- streams not yet running freely ugh slopes where the grass is brown from its long sleep.

oon it will be green and dotted flowers, already beginning to w in white and gold among the nlands of Berne.

hese Alpine mountains are tre- adous things. Their pointed peaks ib the clouds and finally merge the sunlit mists like ghostly in- itants of the sky, barely discern- from the blue which lies over valleys, lakes and distance.

Their age-old barrier is reflected in the houses and the people, clearly dividing in this refrain the square, yellow buildings of Italy from the steep-roofed, wooden chalets of the Swiss, perched on seemingly vertical slopes where even the steep mountainsides are terraced to make use of every useful piece of land.

And beyond the mountains lie the more fertile valleys and lake district where most of the Swiss people ply their trades.

Switzerland is a contradiction of unity and dissension.

Broadly, it has three regions speaking different languages — German, Italian and French. Its numerous internal interests are often highly divergent, but nationally they are all Swiss, and as a nation they remain united.

To the Swiss, neutrality and impartiality are a religion.

Their country is completely vulnerable in a military sense, but its importance among European nations as a buffer State, and its own explanation of it, is its greatest protection.

It is also completely dependent on its neighbors, for its industries are largely centred on specialised processing of materials it imports, just as an external market for finished products must be maintained.

Swiss neutrality imposes upon its national conscience a desire to do good works and to provide a national forum for the world. One detects something more than self-interest in this. It has escaped the immediate effects of wars raging around it, and, in return, makes itself available as an instrument through which future wars may be avoided.

In this respect it is unlike any other country in Europe. It is with the amateur and professional peacemaker of the world.

The Swiss Short-Wave Service is largely an expression of this. It exists to display Switzerland to the world, and to keep in touch with the nearly 10 pc of its people abroad.

## OBJECTIVE COMMENTARY

But in its world commentary, it is almost painfully objective. It must not overplay news or commentary; at any cost it must not offend.

Just as you can buy any newspaper on every Swiss railway bookstall, from Pravda to the Manchester Guardian, so you will hear the facts as presented by all nations from Swiss radio. "We read them all," someone said, "and then we turn to Switzerland for the truth." I make no further comment on this.

The SW Service is operated from Berne, which houses its studio. Free use is made of recordings, mostly on tape. A bank of 100 KW transmitters at Schwarzenburg, near Berne, is largely Swiss-made by the firm of Hassler, one of several specialising

# POPULAR SCIENCE QUIZ

*Q: What order of temperature is developed during an atom-bomb explosion and how would it compare, for example, with the temperature of the sun?*

A. It has been estimated that the temperature developed during the explosion of a large A-bomb reaches about 50-million degrees centigrade, as compared with about 20-million degrees in the sun itself. Realisation of this fact led scientists to the belief that the atom bomb could "trigger" a fusion reaction similar to that which occurs in the sun, where hydrogen atoms are changed to helium, with the release of an enormous amount of energy.

*Q: How powerful was the big atom bomb, anyway?*

A. The power of the atom bomb is very difficult to explain in everyday language, even by trying to compare it with so much TNT or the simultaneous explosion of so many wartime bombs. However, it has been estimated that the US atom bomb exploded at Bikini lifted 10-million tons of sea water to a height of two miles in one fantastic explosion.

*Q: How fast can an atom-powered submarine travel under water?*

A. Performance details of atom-powered submarines, both completed and in course of construction, is a closely guarded secret. However, non-technical Press releases indicate that they can match their underwater manoeuvres with surface destroyers, possibly with something to spare. Speeds up to 50 mph are therefore assumed.

*Q: Is speed the only new menace posed by atom-powered submarines?*

A. Their speed is a very big factor, because it means that they can elude defences that much more easily. However, their independence of diesel power and batteries means that they can stay under water for very lengthy periods, thus avoiding risk of detection by the ever-expanding radar defence systems. Also, their high speed turbine propulsion systems create much less sonic disturbance in water than diesel propulsion, which conventional submarines have to rely upon for a large proportion of the time. They are thus harder to detect.

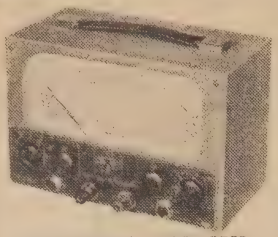
*Q: Is the range of television strictly limited to the 50-odd miles usually accepted?*

A. No, not if we observe the word "strictly". Reflection from the ionosphere and other forms of anomalous propagation can transport television signals over much greater distances on occasions, just as happens with any form of VHF transmission. US television authorities are expecting a crop of freak reception reports as the present sunspot activity reaches its peak in 1957-58. Never before has there been such a profusion of VHF transmitters and receivers in use, nor the same opportunity to observe freak reception conditions.

*Q: Is going without breakfast a good way to diet and slim?*

A. Dietitians say that it isn't because, after a long period of abstinence during the night, the body most needs food at breakfast time. Going without breakfast needlessly accentuated the natural craving for food and can lead to general irritation and even excesses later in the day. Have a moderate breakfast they say—fruit juices, egg, toast, unsugared coffee, &c.—and go easy later on. Between-meal snacks and fancy desserts for lunch the far more fattening than the breakfast you would normally have eaten.

# UNIVERSITY service aids . . .



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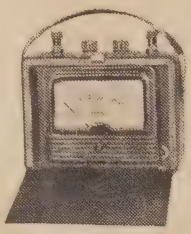

Model EXT/2: Readily portable, this low and medium range ohmmeter is mounted in hard rubber case with hinged protecting flap over the meter. Uses 4in square meter Model R4.— Ranges 0-20, 0-500, 0-5000 ohms. £12 plus Sales Tax 12½ pc.

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Model MVA/2: This popular Multimeter is built to careful standards of accuracy and utilises 1 pc resistors throughout to ensure maximum efficiency. It covers AC-DC and output voltage ranges up to 1000 as well as D.C. current ranges up to 250 milliamperes. In addition there is a special 10 ampere D.C. range as well as four ranges of resistance up to 1 megohm.

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# FROM THE EDITOR — Continued

radio, telephone, and advanced
·tronic equipment, some of local
ign, but a good deal under for-
n licence.
.ll normal bands are used with a
ection aerial curtain, radiating
-degree arms. An impressive
se—switching installation allows
·cting to be achieved—with any
d. All switching operations are
·ied out from the station itself.

## ANY PROBLEMS

he technical services are main-
ed by the Swiss PTT (PMG), but
grams are supplied by a private,
-profit-making company. I spent
ery pleasant day inspecting the
ss installations with the Hassler
f, Mr. Walter Keller, whose firm
existed for more than 100 years,
Dr. H. Wehrlin, its chief en-
·eer.
wiss radio is complicated by a
icult terrain and the use of three
guages. This calls for three
ultaneous programs. To fill up
e of the awkward valleys, FM
ions are being installed; once
in their operation bumps the lan-
ge problem.
means, too, that a full-blown
ss set needs AM medium waves,
ultra-shorts, and SW bands as
l. Cost is therefore high, par-
larly as most sets are imported
n Germany and France.
ll radio is national and carries
advertising. There is open hos-
y from the newspapers, who
commercial broadcasting, if it
uld come. As a result, Swiss
s services find it hard going
ut the TV scene is even worse.
population of 4½-million in bad
ain is bad enough, but the 3-
guage setup and program cost are
despair of its operators.
eadquarters are in Zurich, where
medium-sized studio, using Eng-
gear by Pye, is in use. The ser-
is experimental in that, although
ular programs are broadcast, it
a shoestring budget and its
re is up for review in 1957. Un-
then it will largely be marking
e.
here are at present 4 transmitters
various types — 7 projected by
.

## V RECEIVERS

here are about 12,000 sets, of
ch about 50 pc are in restaurants
pay about £10 per year licence
—£5 per year for a private set.
1959 it is hoped for 150,000 sets,
the future is uncertain.
rograms originate mainly in
tzerland and, again in the inter-
of neutrality, it is policy that
should be so, although German
Italian programs are used
ugh the Eurovision network.
roadcasting hours are short — 1½
rs on six nights per week, plus
e sporting and children's ses-
s. Live artist and film shows are
; some of the latter are not good
er in quality or in content. Never-
ess, the Swiss are trying hard
again the newspapers have little
pathy for their efforts.
articularly interesting are the
rowave sets of stations erected on
towers in the Alps to carry
ovision and relays to Italy and
many. These are locally built,
y by Hassler, and operate around
Mc.

The towers also carry an all-round looking array of stacked dipoles in some cases to radiate the programs for local use, although some repeater stations are for that purpose only and are located in remote places.

These micro-wave links are widely used in Europe, although Italy plans to use co-axial cables for shorter distances.

In Switzerland, programs from Italy show little deterioration. I saw a bike race from San Remo at Zurich with excellent quality.

However, by the time they have spanned the Continent, particularly with conversion from French 819 or English 405 lines, they are often not good. Public reaction to programs and their standard is quite immediate in the cafes, where so many gather in the evenings.

I am continually meeting Australians. The Swiss SW Spoken Word sessions are arranged by Kenneth Henderson, an Australian. Lucas Stabelin, the musical director, is a Swiss who spent some years out here.

## CONTRAST

The going along the Rhine valley from Switzerland is a contrast in beauty and ugliness. The beauty is supplied by the Rhine and its surroundings; by the colorful barges and paddle steamers which battle their way against the current to Berne in long strings; by the steep, often rugged hills, dotted with ruined castles; by villages grouped around church spires, and by beautiful old towns like Boun, the birthplace of Beethoven.

The ugliness lies mainly in the smashed and shattered ruins of war, still open to the sky after 10 years and concentrated around the railways and bridges of Coblenz, Mannehein, Maintz, Cologne, Stuttgart and Dusseldorf.

Cologne is even today a shell of a city, a brave show of shop fronts on what has been salvaged from a once smoking pile; from which rises the miraculously erect walls and towers of the Cathedral, a stone's throw from the centres of greatest destruction.

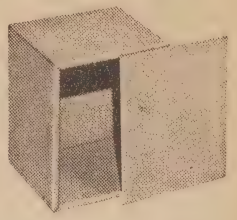
The organ plays again while the sun sets behind the windows. Buildings are filling the open spaces in the city, but one wonders if the scenes of desolation can ever be completely wiped away.

## GERMAN ACHIEVEMENT

It has been said that in the last 10 years West Germany has achieved miracles. Split asunder by foreign occupations, most of the time under the direction of the victorious Allies, its industries broken, and its cities in ruins, Germany today has smashed its way into the markets of the world in almost every branch of engineering.

I was not able to spend more than a few days there, mostly in Cologne, but there is no doubt about the purpose and hard work which has brought West Germany back again as the most powerful industrial force in Europe. It is in everything you see there, in the rebuilt factories which have taken precedence over the repair of cities and homes, in the atmosphere of the people determined to rise again.


# METAL UTILITY CABINETS



**This line of cabinet is for housing electronic equipment of all types. It has fixed back and removable front. Basic colour is grey.**

| Catalogue No. | D. | W. | H | Price plus Sales Tax |
|---|---|---|---|---|
| MC6 | 6in | 6in | 6in | 8 3 |
| MC5 | 5in | 6in | 9in | 9 4 |
| MC7 | 7in | 8in | 10in | 13 9 |
| MC67 | 6in | 7in | 12in | 13 9 |
| MC81 | 8in | 10in | 10in | 17 0 |
| MC811 | 8in | 11in | 12in | £1 1 0 |
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| SF71 | 7¼in | 11in | 6¼in | 16 0 |
| SF8 | 8¼in | 13in | 8in | 19 3 |
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# PUBLIC ADDRESS AMPLIFIERS

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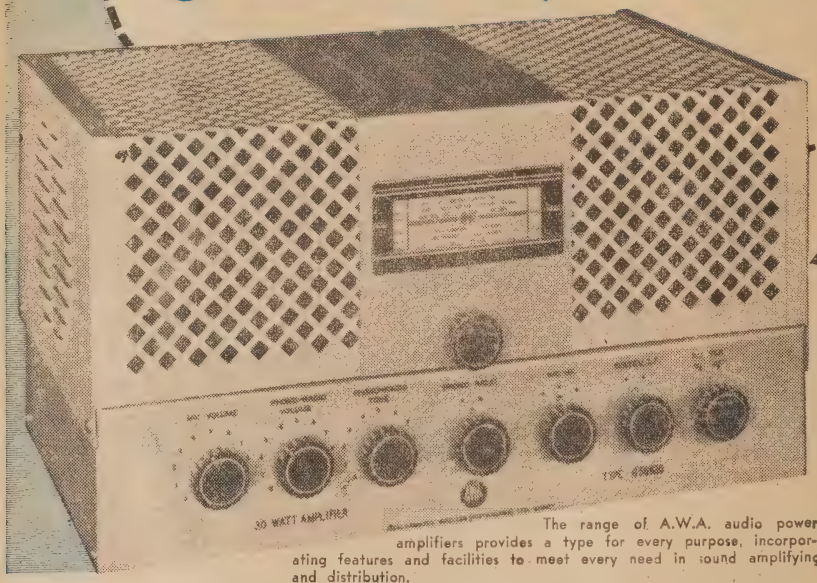
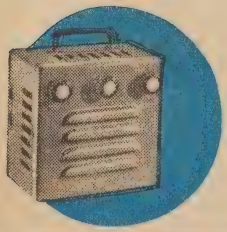


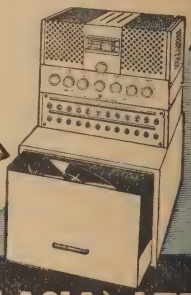
The range of A.W.A. audio power amplifiers provides a type for every purpose, incorporating features and facilities to meet every need in sound amplifying and distribution.

Designed and built to the same high standards of quality workmanship and performance for which the Company has established a world-wide reputation in broadcasting and communication equipment, models PA825 15 watt, PA826 30 watt and PA827 70 watt are illustrated above with radio tuner PA831 fitted. The amplifier protective cover has provision for mounting a monitor speaker.



5 watt portable amplifier type PA806 provides ample power for the needs of most indoor gatherings and many outdoor applications.

Radio, record playing, and speaker switching units assembled with the amplifier to form a centralised system.



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e quality of design and work-
hip is fine. Whether it is motor
which dominate most highways
are well represented even in
and France, or its radio and TV
which have similar acceptance,
are something of an eye-opener.
rmany was forced to make al-
a completely new start in tech-
gy, and she has turned this into
greatest asset. Her engineering
lerefore, as modern as the cur-
year.

German radio and TV organisa-
is the result of systems in-
rated by Britain, France and the
in their respective zones. Bri-
based her system on the BBC
central control within the zone
regional stations in support.
ce did likewise

## SYSTEM

ıe American zone favored the
idea of many self-supporting
ons, each an independent unit.
that Germany is managing her
affairs, the roots taken by the
ous broadcasting and TV com-
es are too deep to shift, and
e seems little likelihood of a
ge for some time to come—
ver.

ıere is of course a certain con-
between broadcasting interests
no unified control.

ıe rapid introduction and growth
M is largely another wartime
uct. After the war, West German
ons were severely limited in
ber and in the total power
Kw) in each zone. To cover
country and to provide a second
ram, FM stations were built.
ıere are now about 135 of them
ıgainst only a few big medium
e transmitters, whose main jus-
ation soon will be to serve owners
ld-fashioned sets. The standard
iver in Germany today has ful
e coverage. Medium or broad-
, several SW bands, and an
section, all available by band
ching, using the same valves
both signal and IF channels.
is estimated that 80 pc of list-
s use the FM bands, but I have
means of cross-checking this.
ıest station of power is 100Kw
ı aerial gains of up to 12 times.

## ABORATE SETS

ısh-button tuning and/or band
ction is the rage, and is here to
on even small sets. Larger
s have multiple speakers and the
ly elaborate types sound really
l. All are mantel or table types,
ept a few deluxe console radio-
ns. Even portables have push-
ons, and an FM channel on some
ıels.

here is no commercial broad-
ing (or TV) in Germany as we
w it and considerable opposition
it from government quarters,
ence fees for radio are about
/- per year. This is a basic
and must be paid by TV set
ers as well." Thus a station with
illion listeners in its area has a
income. This is reflected in the
-rate technical setup in Cologne,
cal of a good German installa-
. Its studios include a fully-
ıpped concert hall of medium
, and control-room facilities most
sh by Australian standards.
he main patching panel, which
nects pretty well anything to
thing else by a system of plug
tacts, is the technical heart of the

**(Continued on Page 114)**


# *Chosen Exclusively*

for Olympic Games
Coverage by over
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Countries

**PROFESSIONAL MODEL**

**TAPE RECORDER**

Already acknowledged as the finest professional tape recorder on the Australian market, the Byer "77" has now been chosen for the entire broadcast coverage of the 1956 Olympic Games and will be used by upwards of 120 visiting overseas commentators.

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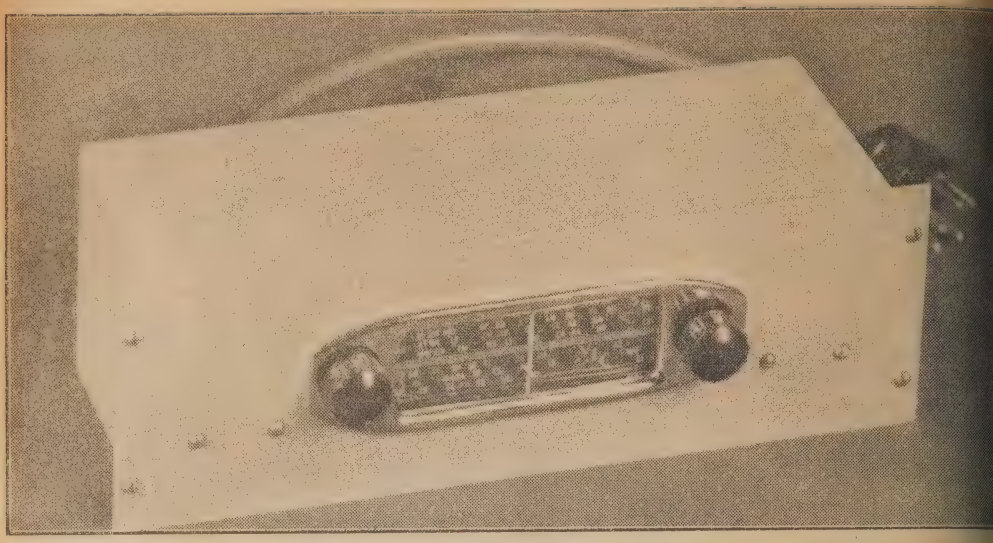


The complete tuner housed in a standard control unit box. The right hand knob is the tuning control and the left hand one the variable selectivity switch. The five pin plug connects to any of the Playmaster Control Units.

# NEW BABY PLAYMASTER TUNER

**Here is a tuner which many of our Playmaster enthusiasts have been seeking. Although small and compact it can still hold its own against many larger designs, or even out-perform those of more conventional design. If you want a miniature tuner with better than average performance, this is it.**

by Philip Watson

MANY amplifier enthusiasts are apparently intrigued by the idea of a tuner in the same style box as already in use for the control unit, and there is no doubt that the idea has much to recommend it. The main considerations are, of course, purely physical, but these can be quite important when one is planning a cabinet to hold the various units.

With both tuner and control unit housed in identical boxes the amount of cabinet space is considerably reduced and they may logically be mounted side by side or one above the other, according to the proposed cabinet shape.

## WIDE RANGE PROBLEMS

Our first idea was to produce a miniaturised version of one of the Wide-Range Tuners, such as the Wide-Range No. 2, since these have been extremely popular. However, a few minutes with a rule, control box, and some of the major components was sufficient to convince us that the problem could be quite a sticky one.

We don't say that it can't be done, but we do emphasise that there are a lot of problems to be solved. To mention only one, there is the difficulty of accommodating a three-gang tuning capacitor in a manner which will allow it to be used with any of the readily available dials.

It seems almost certain that a wide-range tuner could match the control units in frontal area only, the depth having to be increased considerably.

At the same time we felt that there would be plenty of use for a smaller tuner, since not everyone needs, or can use, a true wide-range tuner. This applies particularly to areas of poor reception, which are subject to severe intereference from adjacent interstate transmitters during the hours of darkness.

There was even the prospect that we could still incorporate some measure of IF channel widening. This would make the tuner substantially better than average, even it wou not measure up to the full standa of the Wide-Range Tuners.

This could be done by using scheme we pioneered many years a in an effort to improve the ba width of conventional tuners. It co sists of switching out one of the transformers—the second one in t case—and substituting a resista coupled stage in its place.

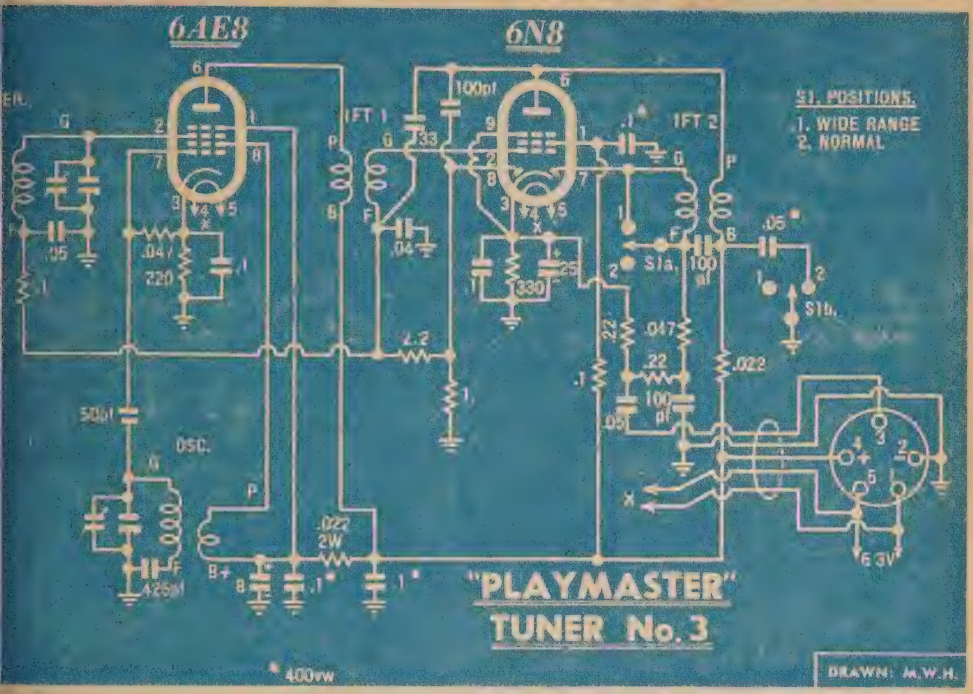
## BROADER IF

The result is an effective widen of the IF channel, even though gain is somewhat reduced. In pr tice the AVC network takes care most of this loss.

We subsequently discovered t the full benefit of the widened ch nel was masked by the presence the aerial tuned circuit, sufficient attenuate the sidebands noticeal even if it did not contribute a gr deal to overall selectivity.

This led to the development of band-pass aerial circuit and Playmaster "Wide Range Tuners" a series of tuners which can claim be remarkably close to the per AM tuner. So popular are th tuners that one equipment manuf turer has recently produced a co

# CIRCUIT FEATURES SIMPLE SELECTIVITY SWITCH




two main features of the circuit are the variable selectivity switch associated with the second IF transformer and the neutralcapacitor from the plate of the 6N8 to the "F" terminal of the first IF. Note the divided diode load, intended to avoid overloading sensitive control units.

l version of one of them—the Range Tuner No. 2", of July,

even without the band-pass circuit, results are noticeably and well worthwhile, when we er the ease with which they achieved. This is particularly en we add a simple neutralisrcuit as a precaution against ration.

## N DETAILS

so the present circuit was d. It uses a 6AE8 converter alve having the advantage of physical size. We would have a similar size valve for the IF ier, AVC and detector, but is nothing like it available at t.

trically, the obvious choice was 8, but we were worried about e. Fortunately, we were able ve this problem, though it looke being a sticky one for More about this in a moment can be seen, the switching ased with the IF transformer is simple and involves a minimum r of critical leads. By strategic g of the switch and IF trans- the additional lead length is bout one and a half inches in rst case.

ion S1a is used to short out the ary of the second IF, leaving ode load only in circuit S1b removes the .05 decoupling capacitor from circuit, allowing the .022 meg resistor to assume the role of a plate load. The 100 pf capacitor from "F" to "B" serves as coupling capacitor under these conditions.

The diode load is in the form of a voltage divider, this being intended to keep the signal level below that which would make volume control in

## PARTS LIST

1 Standard Control Unit box.
1 Chassis (to drawing).
1 Panel to suit box and dial.
1 Midget 2 gang tuning capacitor. 415 pf. Type RMG2 or similar.
1 Miniature dial MSL48 or similar. Suit "H" gang with adapter bush.
1 Midget aerial coil.
1 Midget Oscillator coil
2 Midget IF transformers 1st. & 2nd. 1 15/16in. can.
1 2 pole 2-position switch series 20, type 22 or similar.

VALVES AND SOCKETS

1 6AE8.
1 6N8.
1 9 pin socket with shield.
1 9 pin socket plain. Moulded or wafer. See text.

CAPACITORS

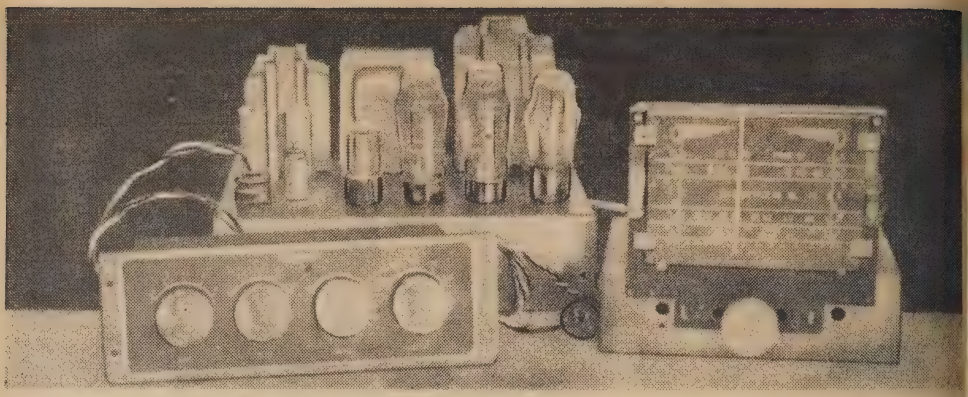
1 25 mfd 40V electro.
1 8 mfd 350V electro. Chassis mounting type.
3 .1 mfd 400V paper.
2 .1 mfd 200V paper.
1 .05 mfd 400V paper.
2 .05 mfd 200V paper.
1 .04 mfd 200V metalised paper.
425 pf mica (padder).
3 100 pf mica.
1 47 pf ceramic.
1 33 pf ceramic.
2 Trimmers.

RESISTORS

1 2.2 meg. ½W.
1 1 meg. ½W.
2 .22 meg. ½W.
2 .1 meg. ½W.
2 .047 meg. ½W.
3 .022 meg. 1W.
1 330 ohm ½W.
1 220 ohm ½W.

MISCELLANEOUS

1 5 pin plug and cover.
2 Small knobs.
1 7 terminal tag strip.
1 8 terminal tag strip.
1 Dial lamp and holder.
2 ¾in. X ⅛in. CSK screws.
2 ¼in. X ⅛in. CSK screws.
Shielded cable, hook-up wire, nuts and bolts, solder lugs &c.



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- **13 Watt Ultra Linear Amplifier (for crystal pick-up**
- **Crystal Playmaster No. 13 (for real economy and hi performance).**
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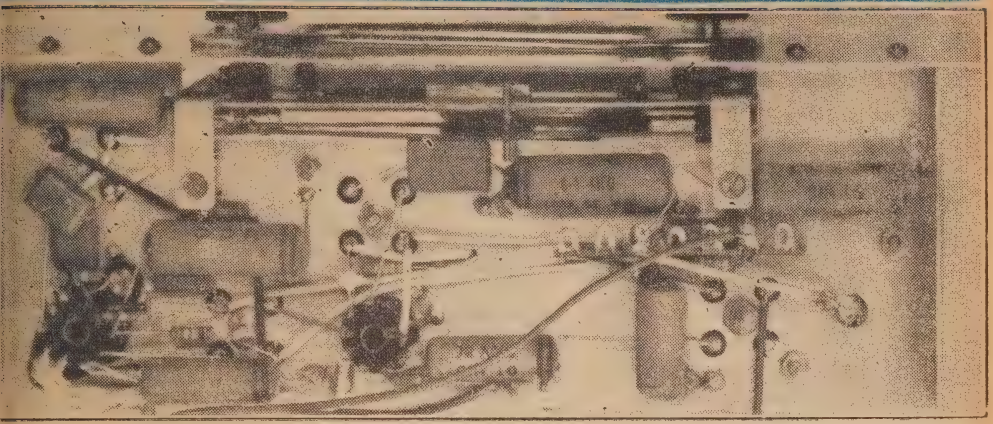
# UNDERSIDE OF CHASSIS AND LAYOUT DIAGRAM



e underside of the tuners. The aerial coil is on the right, the 6AE8 approximately centre with the oscillator coil above it, and e 6N8 on the left. The first IF is between the two valves and the second IF above the 6N8. Note the turned over lugs on the tag strip.

Playmaster Control Units too ıpt. Whether it is retained or not, nodified to deliver even less sig- will depend entirely on the asso- ed equipment.

/ith any tuner where wide re- ıse is required, it is fatal to allow degree of regeneration. Even a ll amount—much less than that ded to bring about oscillation — make the system unduly selec- and all the normal precautions ıld be taken to avoid this condi- .

ınce it is often hard to be per- ly sure that such a condition s not exist we decided to add a ple neutralising circuit, as being ood thing in principle. In fact, we nd it quite beneficial in elimin- g a marked tendency to lop-sided onse, apparently due to a small unt of regeneration, which we d not observe by other means. he neutralising circuit consists of a 33 pf capacitor from the plate of the 6N8 to the "F" terminal of the 1st IF. Its value is not particularly critical, but it is most effective and could well be added to any comparable tuner, where selectivity appears to be unnecessarily high. (It calls for realignment, by the way.)

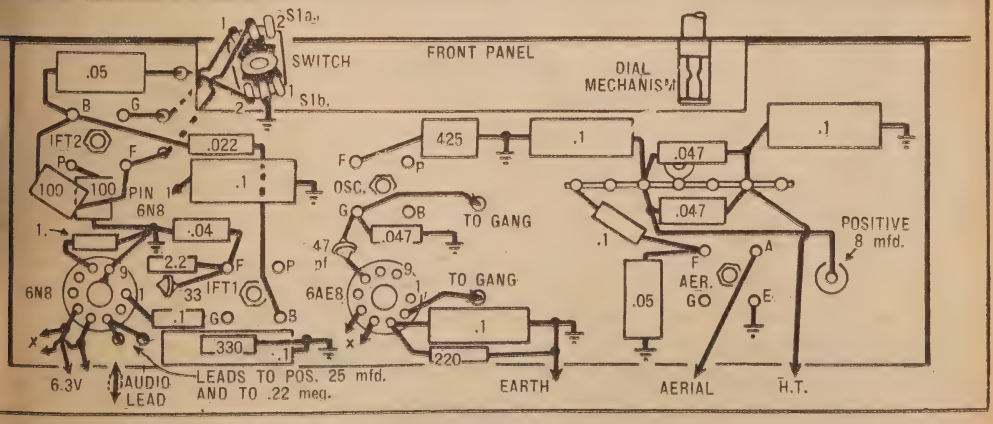
The result is a particularly neat and compact tuner, which is, nevertheless, capable of a really fine performance; a performance noticeably better than that available from a conventional design. In spite of its compact size, it will take a lot of beating.

Coming to the physical details, we have a number of points to consider and it might be just as well if, at this stage, we realise that a unit of this kind can only be considered if we are prepared to undertake a certain amount of modification to standard components.

These modifications are not difficult, but they will call for a little more patience than needed for a purely conventional project. It is part of the price we must pay for something a little unusual.

First, the problem of the 6N8. The maximum height which this valve may assume is such that, when fitted in most sockets, it can barely be accommodated in the control box. Fortunately, the average size appears to be considerably less and the one we bought fitted without difficulty

We used a moulded socket (mounted below the chassis), but quite a saving in space can be effected by using a wafer type. This would appear to be sufficient to accommodate the worst case, though only just. This socket should also be mounted below the chassis and the socket hole made large enough to admit the base of the valve. It may be necessary to shorten the centre shield of the




This layout diagram shows the position of all the components under the chassis. In conjunction with the photograph above and the circuit it should provide all the information necessary to enable an accurate copy to be made. Note that the switch is drawn at a slight angle to show all the contacts.

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No. 6 Tone Control
No. 7 Tone Control

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Playmaster No. 3
Playmaster No. 4
Playmaster No. 5
Playmaster No. 6
Playmaster No. 7
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Playmaster Ult. Linear 9
Playmaster Ult. Linear 10
Playmaster (Crystal) 11
Playmaster 20 watts 12
Playmaster 20 watts 13

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Playmaster No. 2
Playmaster No. 3
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Playmaster modified 6
Playmaster Crystal 7

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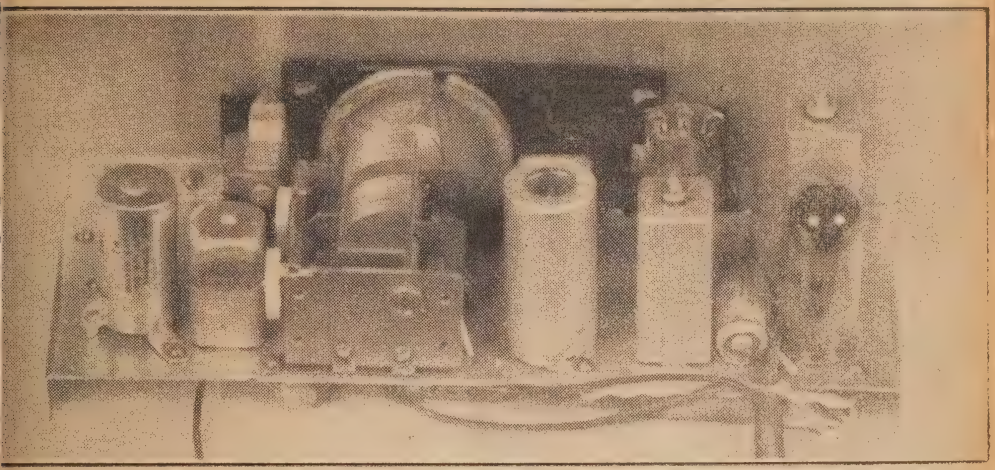
# REAR VIEW OF TUNER AND ALL CHASSIS DETAILS



he tuner from the rear. On the left is the 8 mfd electrolytic, with the aerial coil alongside it. To the right of the gang is the AE8, then the first IF and the 6N8. Between these last two is the 25 mfd electrolytic, while part of the selectivity switch can be seen above the first IF.

ket, which is a good deal longer n the contact lugs, anyway.

n the rather rare event of a par-lar valve still fouling the box it v be necessary to punch a stan-d socket hole in the top of the , through which the valve can be erted or withdrawn. Fortunately h a situation is unlikely.

fext, the chassis. We made ours m a piece of 18-gauge aluminium, there are some advantages in king it oneself, rather than buy-it ready made. Accordingly, we e prepared a drawing showing the important dimensions.

The main advantage of making r own is that it will enable you "tailor" it to fit correctly in your ticular control box, something ich may not be so easy if it is de commercially. It is, therefore, visable to buy your box before mencing the chassis.

Most vital dimension is the height of the chassis, since it must be high enough to accommodate the 6N8 socket, yet not so high that the top of the 6N8 is in danger of fouling the top of the box. There is not much leeway in either direction and the correct distance from the top of the chassis to the inside bottom of the box is $\frac{3}{4}$in.

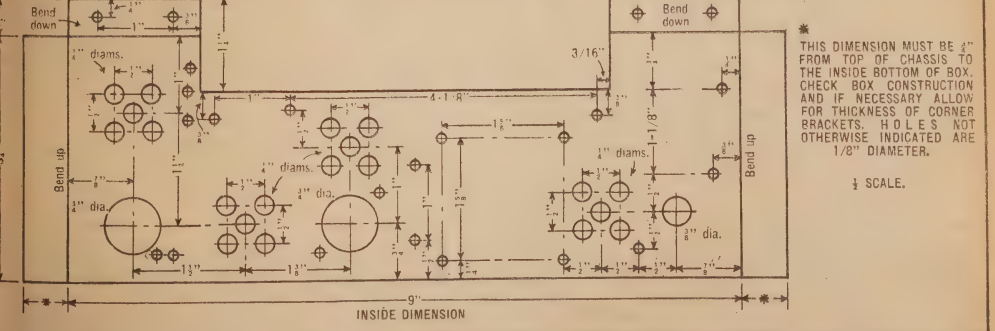
In our case the box used angle brackets in each corner, and it was necessary to allow for the thickness of these, since the ends of the chassis would rest on them. Not all boxes may be constructed in this manner and the chassis will have to be modified accordingly.

Next, drill and punch the various holes as shown in the drawing. It is a considerable help if you can obtain a drilling jig as supplied by some coil manufacturers. Bending up the front of the chassis to take the front panel will help to stiffen it considerably, and even more so when the panel is finally fitted.

The gang is a midget type having a similar law to the "H" and suitable for use with the same dial glass. It has only a $\frac{1}{4}$in shaft and will need to be fitted with an adaptor bush to make it suitable for use with standard dial drum. If this is not supplied with the gang, it should be specified separately.

The type used is available in two sizes; 370 pf maximum capacitance and 415 pf maximum capacitance. Although the 370 pf can be used, if nothing else is available, it will not track perfectly with the standard dial glass, and the 415 pf model should be specified.

The gang is mounted on its side and, although suitable mounting holes are normally drilled in the frame for this method of mounting,




his chassis drawing contains all the data to allow you to make your own. It is drawn to half scale. 18 gauge aluminium will be thick enough, since the front panel will help to stiffen it. Check the box before commencing the chassis.

# BARGAINS

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Leak—Armstrong—Quad—Williamson Amplifiers stocked

All above equipment may be heard at this shop.

may not be tapped, and you will e to do this yourself. The only it to watch is that the plates are damaged by the tap going ugh the hole too far. It is best se a taper tap to get the thread ted, then switch to a plug type. ap and tap wrench may be pur- ed from most tool stores for a shillings. The tap is 1-8in Whit- th.

he mounting feet should be fitted hat they turn under the gang, this will mean that one hole in will have to be countersunk fitted with a countersunk screw re it is fitted.

he dial is identical with that d for the Kar Sets and the Ram- Portable. As supplied, the n will be fastened to the front e with a retaining screw, but this nly a temporary measure to hold drum in place until it is mount- on the gang shaft. In this case drum will occupy the right hand tion of the plate. It may also be essary to move the drive shaft r to the right hand side and re- ng the dial if it is not already as- bled this way

## L MODIFICATION

o accommodate the dial drum in most advantageous position it s found necessary to cut a small in the bent over portion forming top of the dial back plate This pproximately 1¼in long and 3-16in p. It is most easily cut by making umber of hacksaw cuts to the re- red depth and about ¼in apart, aking out the small sections of tal, and cleaning up with a file.

Dial mounting is by means of the mal mounting brackets, but these below the chassis by about 5-8in. s distance may be maintained by ans of spacers or, as in our case simply using extra nuts on the unting bolts. These latter were countersunk and the holes in the unting brackets are countersunk take them. This precaution is essary to avoid the possibility of bolt-heads fouling the bottom the box.

he IF transformers presented nething of a problem There are styles currently available; one can approximately 2 7-16in long l having internal iron cores, which ry their own thread, and the other a can 1 15-16in long and having ernal threading brass rods to ad- t the slugs

## O LONG

he first type is not really suit- e for this job, since it would re- e the chassis depth by an intoler- e amount Thus the second type omes an automatic choice, but n here there is a problem.

lthough the can is shorter, the eaded rods protrude a consider- e distance, and will almost cer- nly foul the top of the box unless y are modified Under the chassis re is rather more room and less nce of trouble.

he best approach appears to be to it until the tuner has been care- y aligned and thoroughly checked rder that the final position of the gs may be determined. When this nt is beyond doubt the surplus rod y be lopped off, and, ideally, new s filed on the rod to allow the use the conventional alignment tool subsequent "touching up" if ever is necessary.

Extreme care must be exercised in modifying these rods, as it is very easy to break the slug internally if too much side-pressure is applied. The best method seems to be to seal the slugs in position, using either some fairly thick lacquer or a lock-nut, and then to remove the IF transformers completely from the chassis. The layout is such that this is not a particularly difficult job, the soldered joints being simply unsweated and lifted away a little

Grip the adjusting rod in a vice and file a new set of flats first, then clip off the unwanted length. It is a good idea to mount them back in the chassis, unwired, and check for size before finally wiring into circuit.

## MINOR COMPONENTS

The minor components are fairly standard for the most part, only one or two requiring special mention. Half watt resistors are used where ever possible, while the paper capacitors are now virtually standard. The one exception is the .04 mfd AVC by-pass on the 1st IF. This is one of the very small metallised paper type, and it would be difficult to accommodate anything larger in this position.

The nominal 50 pf oscillator grid capacitor is actually a 47 pf ceramic though a mica type could possibly be fitted in. Similarly, the 100 pf's around the second IF could be ceramic types with some saving of space

The one tag strip under the chassis needs to be modified to fit in the available space, the centre lug being bent so as to bring the insulating strip hard against the chassis and the tops of the lugs being bent over to reduce their height.

Not all the components could be accommodated under the chassis and we were forced to mount some of them above it. This may be a little unconventional, but is perfectly legitimate. By so doing we were able to keep the leads as short, or even shorter, than if we had tried to accommodate the components underneath.

## DIODE COMPONENTS

Apart from the 8 mfd HT decoupler which is more or less normal above the chassis, we have the 25 mfd cathode bypass for the 6N8, the variable selectivity switch, the diode decoupling resistor and capacitor, the diode load resistors, and the audio-coupling capacitor.

The 25 mfd rests on the chassis and is directly wired at each end, but all the diode components are mounted on a tag strip set between the second IF and the oscillator coil. The tag strip is an eight-terminal type cut down to give four insulated terminals and one mounting lug. The mounting lug is at one end and mounts nearest the oscillator coil.

The diode decoupling resistor runs from this tag strip to the common (centre) contact of the lower switch section (S1a). This arrangement keeps all critical leads short.

Two other leads which must be kept short, apart from the usual grid and plate leads, are those from the AVC diode plate to the 2.2 and 1 meg resistors. These are quite critical although the other end of each resistor is "cold" and may be of any convenient length.

Naturally, the orientation of the valve sockets and coils is important, if minimum lead length is to be achieved and we have prepared a

(Continued on Page 85)


The RADIOMASTER

**RADIOGRAM CHASSIS . . .**

*A great performer on Radio and Records*

**HI-FI MODEL E16 FEATURES.** Eight valves, world range – High gain R.F stage ensures satisfactory long distance reception regardless of location —Push-pull output—Inverse feed-back —Radio-gramophone switch—Combined volume control and power supply switch—Latest type Radiotron valves Straight line dial in four colours size 12¼in by 7¼in—New Magnavox dual cone wide range 12in Speaker – Custom-built—Six months' guarantee

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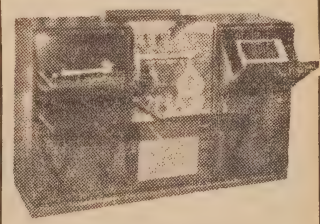

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**The radio-minded amateur will quickly see the possibilities of converting this unit i many interesting devices, such as: Miniature Radio Receiver, Model Control Equipm Baby Alarm, Pre-Amplifier, Inter-Com. Telephone, etc., in addition to its original applicat This unit is supplied with a circuit describing the conversion of the first stage int Receiver with two stages of amplification, which would make this unit capable of receiv transmissions on the Broadcast Band.**
**Operates from standard miniature hearing aid batteries.**
**£3/19/6 less crystal mike. Postage & Packing: 3/6. Interstate**
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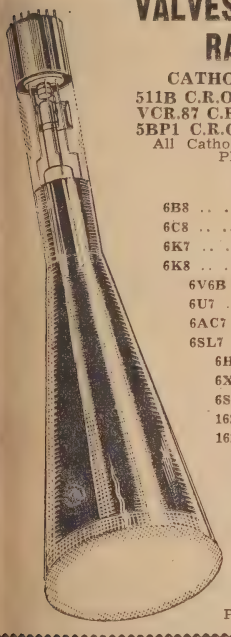

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511B C.R.O. .. .. £3/10/- each
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All Cathode Ray Tubes New. Plus freight.

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**Six Bands.**

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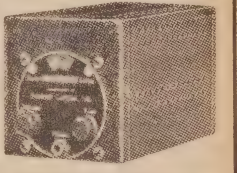
Frequency coverage 195 Kcs. to 420 Kcs. IF frequency 135 Kcs. Sensitivity 3 microvolts to 10 M.W. output. Power output 230 M.W. Current 9 amps 24 volt. Can be converted to car wireless. Dimensions: Height, 4in; width, 4in; length, 6 3-8in; weight 4lb.



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*Illustrated literature available*

**LB1**

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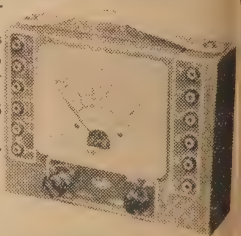

This complete kit enables you to build in a few hours, a first grade AC/DC multimeter. Ranges are:
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Frequency response 40-11,000 cp/s 5db. Fundamental cone resonance 45 cp/s. Voice coil 1in dia. 2.7 ohms at 400 cp/s.

**£7/13/6**
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# PRICE'S RADIO

**5-6 ANGEL PLACE**
**SYDNEY**

**THE RADIO SPECIALISTS**

# Here's your answer, Tom!

e have no doubt that during the recent floods many a rectifier valve did indeed get very t. But that does not make all vacuum diodes wet rectifiers. Not in a general sense, any- y. This is just one of the subjects in this month's bag. We also have the "Case of the Haunted Loudspeaker" and questions on frequency multipliers and aerial masts.

you ever seen a wet rectifier? nless you are one of the older tion, it is very unlikely that ive. And yet we blithely carry king about dry ones. This state irs apparently does not please

**ave often noticed in books and zines that metal rectifiers, such pper oxide and selenium types eferred to as "dry" rectifiers. ere are dry rectifiers, there must be wet ones. Surely s are not wet?**

we have said in the introduc- here have been quite a few wet r valves in this part of the lately, but we also agree that

*. . . quite a few "wet" rectifiers."*

ns unjustified to classify them t, just on this basis. So there e some other reason for recti- eing called "dry".

story goes back to the begin- f radio, Tom.

ough the first vacuum tube in- was essentially a rectifier, a it was not until many years that it was used to rec- ternating current from the The DC required for the ope- of early valve types was from batteries, wet or dry, just ay, where mains supply is not ble

ever, early experimenters soon that batteries were expensive ey began looking for some r source of supply. One of sources was the mains, but the m in many places was how DC from the AC mains. Be- eing bulky and expensive motor-generator sets were noisy things, requiring frequent attention

Even before the invention of the thermionic diode, it was well known that certain pairs of metals in an electrolyte passed current in the one direction more easily than in the other. Such pairs were used as detectors in early receivers, although not with very much success.

After some experiments, however it was found that such apparatus could be used to rectify AC from the mains. Tantalum and lead, in diluted sulphuric acid, and aluminium and lead in diluted sulphate of ammonia, were found to be the most effective. The maximum current that could be rectified was only limited by the size of the metal plates.

Rectification occurs at the extremely thin coating of oxide which forms on the tantalum or aluminium. This oxide prevents the flow of current in the one direction, but breaks down and allows conduction, if the voltage on the plates is reversed.

The peak voltage ratings of such cells was about 50 volts and, for higher voltages, several cells had to be connected in series.

## MANY JARS

The net result was a number of jars containing the metal plates and the electrolyte for each of the cells. The electrolyte was a highly corrosive liquid which had to be watched all the time to prevent it from causing damage to other equipment on the bench.

The electrolyte being a liquid, the whole arrangement was rightly called a "wet rectifier". We have even heard of them being referred to as "slop rectifiers".

An alternative solution for these early experimenters was the then newly-discovered copper-oxide rectifier, which required no liquid electrolyte and virtually no attention. Little wonder that they were referred to as being "Dry". There was certainly a lot less mess associated with them.

In the meantime, rectifier valves made their appearance, and the sloppy and corrosive wet rectifiers have disappeared from the radio scene. Only the seemingly incongruous "dry" metallic rectifiers remain today as a reminder of the days when there were wet ones, too.

And now to the mystery of the month.

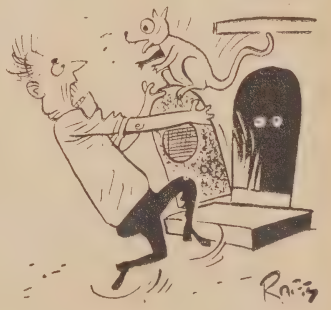
**Recently I installed a loudspeaker for my amplifier, using a disused fireplace for an enclosure. It performs beautifully, but at times it gives forth funny noises, even when it is not connected to the amplifier.**

From the address given on your letter, Tom, you live in an area where there is a considerable amount of "bush" still left. And believe it or not, this fact may prove the solution to the peculiar behavior of your loudspeaker enclosure.

Our suspicion is heightened by the fact that you are a new Australian and not quite up to what can happen—and did happen at least once to our knowledge—in this unfamiliar country.

In locations like yours, there lives a certain kind of marsupial which, in colloquial language, is referred to as the "possum". Of nocturnal habits, the possum likes to select dark places for its daytime snooze. And more often than not, a disused chimney provides ideal sleeping quarters for him. If the fireplace is boarded up, so much the better.

Now, our friend the possum is a very restless sleeper; hence the noises during the day. And seeing that he makes that much of a racket when he is asleep, it would be quite



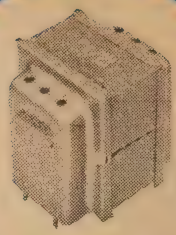
*". . . a certain type of marsupial."*

unreasonable to expect him to be tiptoeing around, when he is awake.

This, of course, also explains why the "loudspeaker" at times makes itself independent of the amplifier.

The obvious remedy would be to prevent the possums from entering the chimney, which could easily be done by placing a piece of wire netting over the top of the chimney

# Ferguson



## PREFERRED TRANSFORMER RANGE

### POWER TRANSFORMERS FIRST PREFERENCE

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|---|---|---|---|---|
| PF 130 | 230-240 | 285 | 100 | 6.3VCT/2A 6.3V/2A 5V/2A |
| PF 130F | 230-240 | 285 | 100 | 6.3VCT/2A 6.3V/2A 5V/2A |
| PF 151 | 230-240 | 285 | 60 | 6.3V/2A 5V/2A |
| PF 151F | 230-240 | 285 | 60 | 6.3V/2A 5V/2A |
| PF 152 | 230-240 | 285 | 125 | 6.3VCT/2A 6.3V/2A 5V/2A |
| PF 165 | 230-240 | 385 | 60 | 6.3V/2A 5V/2A |
| PF 170 | 230-240 | 285 | 80 | 6.3V/2A 6.3V/2A 5V/2A |
| PF 185 | 240 | 150 | 30 | 6.3V/2A |
| PF 201 | 240 | 225 | 50 | 6.3V/2A |
| PF 265 | 230-240 | Secondary Volts | | 17 TAP 11.5, 10, 8.5/4.2A |
| PF 299 | 240 | 285 | 40 | 6.3V/2A 5V/2A |

### POWER TRANSFORMERS SECOND PREFERENCE

| CODE NO. | PRIMARY VOLTS | HTV ASIDE | H.T. MA | FILAMENTS |
|---|---|---|---|---|
| PF 160 | 230-240 | 385 | 100 | 6.3V/2.5A 6.3V/2.5A 5V/2A |
| PF 164 | 230-240 | 325 | 100 | 6.3VCT/2A 6.3V/2A 5V/2A |
| PF 166 | 230-240 | 325 | 60 | 6.3V/2A 5V/2A |
| PF 168 | 230-240 | 385 | 80 | 6.3V/2A 6.3V/2A 5V/2A |
| PF 169 | 230-240 | 325 | 80 | 6.3V/2A 6.3V/2A 5V/2A |
| PF 173 | 230-240 | 425 | 175 | 6.3VCT/3A 6.3V/2A 5V/2A |
| PF 174 | 230-240 | 285 | 150 | 6.3VCT/2A 6.3V/2A 5V/2A |
| PF 175 | 230-240 | 385 | 150 | 6.3VCT/2A 6.3V/2A 5V/2A |
| PF 545 | 240 | Ext. 1000 | 2 | 6.3V/3A 6.3V/6A |
| | | 350 | 20 | 4V TAP 2.5/2A |
| PF 439 | 240 | 32V | 60 | 240-32 STEPDOWN |

### POWER CHOKES FIRST PREFERENCE

| CODE No. | HY IND. | D.C RES. | D.C MA |
|---|---|---|---|
| CF 102 | 15 | 300 | 60 |
| CF 103 | 30 | 420 | 60 |
| CF 105 | 15 | 250 | 80 |
| CF 109 | 20 | 225 | 150 |
| CF 196 | 20 | 130 | 125 |

### POWER CHOKES SECOND PREFERENCE

| CODE No. | HY IND. | D.C. RES. | DC MA |
|---|---|---|---|
| CF 106 | 12 | 200 | 100 |
| CF 111 | 16 | 165 | 200 |
| CF 112 | 10 | 70 | 250 |

If you have difficulty obtaining regular supplies, contact us immediately.

### OUTPUT TRANSFORMERS FIRST PREFERENCE

| CODE NO. | WATTS | PRIM Z | SEC. Z. | RESPONSE |
|---|---|---|---|---|
| OP 9 | 15 | 10,000, 6600 5000 PP | 500, 250, 125 | 50-8000 C/S |
| OP 13 | 25 | 10,000, 6600. 5000 PP | 500, 250, 125 | 50-8000 C/S |
| OP 24 | 5 | 5000 SE | 8.4 OR 2.1 | 30-15,000 C/S |
| OP 25 | 15 | 10,000 PP | 15-3.7 OR 8.4-2.1 | 20-30,000 C/S |
| OP 44 | 10 | 5000-2500 SE | 500, 250. 125 | 50-8000 C/S |
| OP 54 | 10 | 5000-2500 SE | 15, 12.5, 8.4, 6.5, 4, 3, 2.7. 2.3, 2. | 50-8000 C/S |
| OP 58 | 15 | 10,000, 6600. 5000 PP | 15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2. | 50-8000 C/S |
| OP 63 | 15 | 10,000 PP | 15, 3.75 | 30-15,000 C/ |
| OP 112 | 6 | 10,000 PP | 2, 8 SUIT ROLA 12 OX | 40-12,000 C/ |
| OP 113 | 6 | 5000 SE | 2, 8 | 40-12,000 C/ |
| OP 118 | 6 | 8000 PP | 2, 8 | 40-12,000 C/ |

### OUTPUT TRANSFORMERS SECOND PREFERENCE

| CODE NO. | WATTS | PRIM Z | SEC. Z | RESPONSE |
|---|---|---|---|---|
| OP8M | 15 | 10,000 PP | 500, 250, 160, 125, 100, 83.5, 7.5, 62.5, 55, 50 | 50-8000 C/S |
| OP 17 | 32 | 10,000, 6600, 5000 PP | 500, 250,125 | 50-8000 C/S |
| OP 19A | 15 | 5000 PP | 12.5, 8, 2.3 | 30-15,000 C/S |
| OP 65 | 15 | 10,000 PP | 8.4, 2.1 | 30-15,000 C/S |
| OP 67 | 15 | 5000 PP | 15, 6.5 | 20-30,000 C/S |
| OP117 | 6 | 5000 PP | 8, 2 | 40-12,000 C/ |
| OP119 | 6 | 6600 PP | 2, 8 | 40-12,000 C/ |
| OP 60 | 32 | 10,000, 6600. 5000 PP | 15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2. | 50-8000 C/S |

### VIBRATOR TRANSFORMERS FIRST PREFERENCE

| CODE NO. | PRIM VOLTS | D.C. VOLTS | O'PUT MA | BUFFER FULL SEC |
|---|---|---|---|---|
| VT 104 | 6 | 250 | 60 | .004 |
| VT 210 | 12 | 250 | 60 | .006 |

### VIBRATOR TRANSFORMERS SECOND PREFERENCE

| CODE NO. | PRIM VOLTS | D.C. VOLTS | O'PUT MA | BUFFER FULL SEC |
|---|---|---|---|---|
| VT 116 | 24 | 250 | 60 | .005 |
| VT 208 | 6 | 250 | 60 | .01 |
| VT 209 | 12 | 250 | 60 | .08 |
| VT 211 | 32 | 250 | 60 | .005 ea. hal |

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And so, having disposed of the stery we go on to the next questn.

**One often reads about frequency ublers and frequency multipliers. iat are these devices used for and w do they work?**

Frequency multipliers, Tom, do it as their name suggests; they uble, treble, or quadruple; in ier words, multiply a certain freency. If you feed, say, a 100 Kc nal into them you will get a 200, ) or 400 Kc signal from them, deding on the degree of multiplican.

Their use stems mainly from the t that it is very hard to make illator's stable enough for use on higher frequency bands, from out the 50 Mcs upwards. But in ed frequency communication ipment, it is particularly importt that the frequency of the oscilor should not drift. So it is comn practice to provide a stable oscilor which works at a fairly low quency, and to obtain the required quency by using frequency multiers.

Crystal-controlled oscillators are remely stable, but their upper freency limit rarely exceeds 10 Mc. If advantage of crystal control is to retained at frequencies higher n this, frequency multiplication ist be employed.

The principle of frequency multication is rather simple and deds on the fact that no valve has perfectly straight characteristic ve. The result is that if we feed signal to a valve, the output will be an exact amplified replica, will be slightly distorted. One uld also say that the output will ntain a certain proportion of harnics, which were not present in input.

## ARMONIC DISTORTION

We go to no end of trouble in audio plifiers to reduce this harmonic tortion to levels where it does not erfere with the signal being ampli-. For frequency multipliers, on other hand, the valves employed operated deliberately on the ved portion of the characteristic, rder to produce as much harmonic tortion as possible.

The desired harmonic is then septed from the rest of the output placing a resonant circuit tuned the harmonic into the plate circuit the multiplier valve.

The output from this stage can be to additional multiplier stages, in same manner, to obtain the frency actually required.

Multiplier stages actually produce rmonics up to the thirtieth, or even her, and theoretically any of these uld be picked out and utilised. Why n several multiplier stages? Well, ause the higher the harmonic, the er is its amplitude; in practice, the plitude of harmonics higher than sixth is often too small to be practical use.

This may not be very important in civers, where only a minimum ount of energy is required from oscillator, but transmitters need considerable amount of power to ve them and the power must come m the multiplier which supplies operating frequency.

fence, for a multiplication of fifteen times, it is usual to find two multiplier stages, the first one giving three times the oscillator frequency, and the second one multiplying this another five times (or vice-versa), the output being fifteen times the frequency of the master oscillator.

**In a recent article on TV aerials in your magazine reference was made to a TV aerial mast which could also be used as a "self-radiating" broadcast aerial. How can one and the same aerial be used by two stations operating on different frequencies? And what is meant by "self-radiating"?**

The article you saw, Tom, described the recently completed TV aerial mast near Oklahoma City in the USA. This tower or mast is at present the highest man-made structure in the world. But nowhere in the article was it stated that the same aerial would be used by both the TV and the M/W broadcasting station.

For the TV station the mast is just a means of getting its aerial up as high as possible. The aerial proper is insulated from the steel mast and consists of a large number of arrays designed to give as good as possible coverage horizontally but to prevent

**(Continued on Page 85)**


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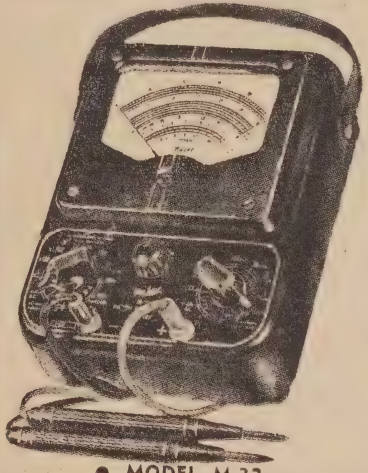

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Current AC. 0/1 mA. (for use with ext. current transformer).
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# DETAILS OF AN AUSTRALIAN

On the following pages, we present details of a high-performance television receiver de signed in Australia by engineers of the Valve Application Section, Philips Electrical Indus tries Pty. Ltd. The details are presented for readers' information and not with a view t home construction. The major components required to build a receiver of this kind are no available to individuals as yet, from the Philips organisation nor, to the best of our know ledge, from other radio suppliers. However the circuit and relevant discussion will giv readers some appreciation of what is involved in designing a modern television receive

## BASIC FEATURES OF THE DESIGN:—

The following features are embodied in the receiver:

(a) A turret tuner of modern design suitable for the 10 Australian channels, using a low noise cascode R.F. amplifier and a triode-pentode as oscillator-mixer.

(b) A stagger tuned video I.F. amplifier of four stages, suitable for intercarrier reception, with vision carrier at 36 Mc/s and sound carrier at 30.5 Mc/s.

(c) A germanium diode as video detector.

(d) A video amplifier of good bandwidth, high gain and excellent transient response, relatively unaffected by spread in output circuit capacitance.

(e) A high gain, two-stage, intercarrier sound I.F. amplifier, employing a limiter in the second stage which provides envelope feedback to the first stage. This reduces A.M. effects which may occur in the intercarrier beat.

(f) A pair of germanium diodes, matched for use in a balanced ratio detector circuit, which in itself has inherently good A.M. rejection properties.

(g) A single tube A.F. system, delivering 3½ watts output from a moderate input signal, including substantial inverse feedback.

(h) A keyed A.G.C. system with good control characteristics.

(i) A noise inverter, which ranks with flywheel systems as a factor in stabilising the picture synchronisation.

(j) A flywheel system, with a balanced phase detector controlling a reactance tube coupled to the line oscillator.

(k) A line oscillator (sinusoidal) of good frequency stability. The sum effect of items h, i, j, and k is to supply a sync. stability of an order previously unknown.

(l) A line output system with harmonic tuning, which reduces the severity of the duties required of the output pentode and booster diode.

(m) A deflection unit of improved linearity and reliability.

(n) A Ferroxdure focusing system unaffected by external fields.

(o) A fine-beam picture tube which maintains good focus over the entire raster.

(p) The tubes and germanium diodes used are:

*6CW7 as cascode R.F. amplifier.*
*6BL8 as oscillator-mixer.*
*6BX6 as video I.F. amplifiers (4).*
*OA70 as video detector.*
*6BL8 as video output amplifier.*
*6BX6 as intercarrier sound I.F. amplifiers (2).*
*2OA72 as ratio detector.*
*6BM8 as A.F. amplifier and output.*
*6BL8 as keyed A.G.C. tube and noise inverter.*
*6BL8 as sync separator and phase splitter.*
*6BL8 as reactance control tube and line oscillator.*
*6CM5 as line output pentode.*
*6R3 as booster diode.*
*1S2 as E.H.T. rectifier.*
*6BL8 as frame sync amplifier half frame oscillator.*
*6BM8 as half frame oscillator frame output pentode.*
*6N3 as full wave rectifier (2)*
*MW43-64 as picture tube.*

The overall sensitivity of the ceiver is approximately 4uV standard vision output. Howe synchronisation holds on signals stantially less than this value.

The main rectified H.T. su voltage is approximately 200 v With the tubes used this voltag adequate to secure full performa and offers some economies in p consumption and component c However, this voltage is n material necessity for the succe operation of the tubes, and if factors indicate a different vo as desirable, the range may accommodated to any value 170 V to 250 V.

In execution the sample rec was built on a vertical chassis. construction offers definite ad ages in accessibility. Contrar American practice the tubes fac front and the components are a rear. The choice made gives t access for testing and servicing cuit faults, but not for tube ch ing.

If, as seems likely, printed w comes to be used more, then and component test points wou be accessible from the rear.

## GENERAL DESCRIPTION OF THE CIRCUIT:—

### THE CHANNEL TUNER UNIT.

The tuner section has two tubes, one double triode (6CW7) as the R.F. cascode amplifier and one triode-pentode (6BL8) used as a mixer oscillator.

The input circuit consists of an R.F. transformer, the primary of which is centre-tapped and earthed. In each lead there is a high impedance I.F. rejection filter.

The tuned secondary, which is part of a bridge, is connected to the grid of one triode of the R.F. tube and to the A.G.C. line via a series-adjustable I.F. filter. The antenna input impedance is for a balanced 300 ohms transmission line.

One coil of the bandpass filter is connected to the anode of the second triode of the R.F. tube. The secondary is connected to the grid of the pentode section of the mixer oscillator tube.

The triode oscillator is of the Colpitts type, and each oscillator coil may be adjusted by means of a copper slug inside the coil. Compensation for frequency drift is obtained by use of a special ceramic condenser with a negative temperature coefficient.

Injection of the oscillator frequency into the mixer is both inductive and capacitive for all channels. The anode of the pentode is connected to the primary of an I.F. bandpass filter, which is link-coupled with the secondary on the receiver chassis.

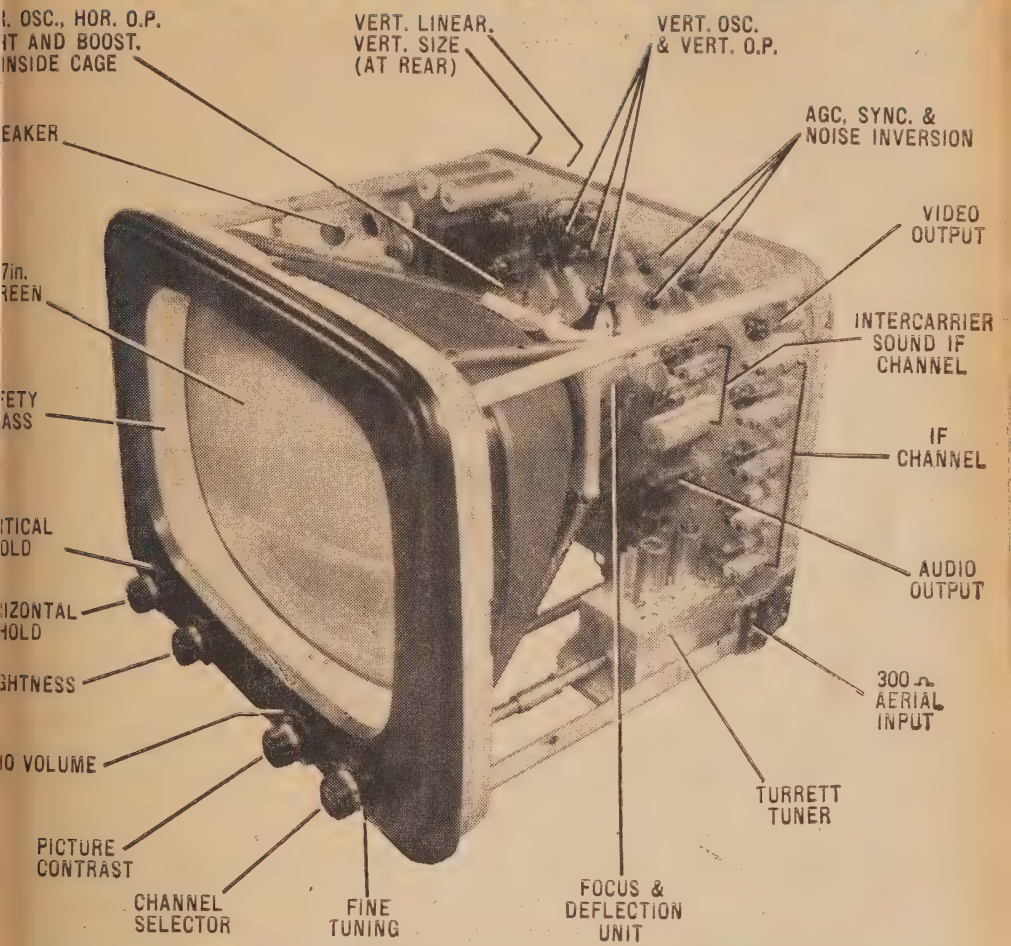
The link coupling is by means of a coaxial lead. This link-coupling contributes to flexibility of the positioning of the first I.F. tube components.

Fine tuning is provided by a variable capacitor controlled b of the dual knobs of the tuner.

The A.G.C. characteristic o tuner section is obtained by layed control on the cascode This delay is approximately 2 and is effective in preservin noise-free qualities of the R. weak signals. On strong s however, the A.G.C. voltage a to the tuner is greater than t the I.F. stages.

With a shorter control chara tic obtained by means of the tial divider circuit, the mixer tected from overload on stron nals, while I.F. overload is a by tapping down the A.G.C.

# ESIGNED TELEVISION RECEIVER




Labels indicate the main layout features of the prototype receiver. Circuit details appear overleaf:

the controlled I.F. amplifiers.
he tuner is efficiently shielded
decoupled, and oscillator radia-
is reduced to a value which
ly satisfies proposed Australian
ts.
igid mechanical construction,
tive indexing and temperature
rection in the oscillator circuit en-
a high order of repetition accu-
, frequency stability and freedom
n microphonics.

### VISION I.F. AMPLIFIER

our tubes, type 6BX6, are used in
vision I.F. amplifier to form a
gered quadruple group. In de-
ing the amplifier the following
edure was adopted:
he vision intermediate frequency
g 36 Mc/s and the sound 30.5
s, a 5 Mc/s passband was chosen
the 3 db points at 36 and 31
Mc/s, 33.5 Mc/s being the nominal centre of the passband.

Calculation gives the different stagger frequencies (f0) and bandwidths (B) as follows:

| | | |
|---|---|---|
| (a) | f0=31.19 Mc/s | B=1.91 Mc/s |
| (b) | 32.54 Mc/s | 4.62 Mc/s |
| (c) | 34.46 Mc/s | 4.62 Mc/s |
| (d) | 35.81 Mc/s | 1.91 Mc/s |

Such a group gives a response curve which meets practical requirements.

In choosing the order of the circuits, 34.46 Mc/s (c), being the heavily damped circuit nearer the vision carrier frequency, is placed between the last tube and the diode.

Both the first and second tubes are controlled by A.G.C., and to minimise conductance variation effects on the passband, should be preceded by heavily damped circuits. Stage 1 needs are already satisfied by the heavily damped secondary of the bandpass transformer, and this is not within the scope of the present discussion. The 32.54 Mc/s circuit (b) may therefore precede stage 2.

The third and fourth tubes are preceded by the lightly damped circuits of 31.19 Mc/s (a) and 35.81 Mc/s (d) respectively, preference being given to placing the 35.81 Mc/s circuit later, in the higher signal level stage. This precludes any likelihood of strong signals near the vision carrier frequency (36 Mc/s) producing an overload effect.

The stages have Gain/Bandwidth products as follows:

Stage 1, 50.5; hence the gain for 5 Mc/s bandwidth is 10.1 times.
Stage 2 is similar to stage 1.
Stage 3 has similar shunt capacity

**(Continued on next page)**

## RESISTORS

| | | | |
|---|---|---|---|
| R1 | 50 | Ω | w.w. |
| R2 | 50 | Ω | w.w. |
| R3 | 270 | Ω | 2W |
| R4 | 330 | Ω | 2W |
| R5 | 270 | Ω | 2W |
| R6 | 1.5 | KΩ | ½W |
| R7 | 10 | KΩ | ½W |
| R8 | 390 | KΩ | ½W |
| R9 | 150 | KΩ | ½W |
| R10 | 1 | KΩ | ½W |
| R11 | 1 | KΩ | ½W |
| R12 | 1 | KΩ | ½W |
| R13 | 56 | KΩ | ½W |
| R14 | 56 | KΩ | ½W |
| R15 | 0.5 | MΩ | pot. |
| R16 | 0.1 | MΩ | ½W |
| R17 | 1 | MΩ | ½W |
| R18 | 270 | Ω | ½W |
| R19 | 1 | MΩ | ½W |
| R20 | 2.7 | KΩ | ½W |
| R21 | 220 | Ω | ½W |
| R22 | 1 | MΩ | ½W |
| R23 | 15 | KΩ | ½W |
| R24 | .1 | MΩ | ½W |
| R25 | .12 | MΩ | ½W |
| R26 | .1 | MΩ | ½W |
| R27 | 1 | KΩ | ½W |
| R28 | 6.8 | KΩ | ½W |
| R29 | 220 | KΩ | ½W |
| R30 | 47 | KΩ | ½W |
| R31 | 40 | Ω | ½W |
| R32 | 22 | KΩ | ½W |
| R33 | 10 | KΩ | ½W |
| R34 | 1 | KΩ | ½W |
| R35 | 10 | KΩ | ½W |
| R36 | 2.2 | KΩ | ½W |
| R37 | 39 | Ω | ½W |
| R38 | 100 | Ω | ½W |
| R39 | 10 | KΩ | ½W |
| R40 | 1 | KΩ | ½W |
| R41 | 2.2 | KΩ | ½W |
| R42 | 39 | Ω | ½W |
| R43 | 100 | Ω | ½W |
| R44 | 5.6 | KΩ | ½W |
| R45 | 1000 | Ω | ½W |
| R46 | 180 | Ω | ½W |
| R47 | 4.7 | KΩ | ½W |
| R48 | 1 | KΩ | ½W |
| R49 | 180 | Ω | ½W |
| R50 | 6.8 | KΩ | ½W |
| R51 | 1000 | Ω | ½W |
| R53 | 20 | KΩ | pot. |
| R54 | 15 | KΩ | 1W |
| R55 | 2.2 | KΩ | ½W |
| R56 | 10 | KΩ | 3W |
| R57 | 56 | Ω | ½W |
| R58 | 18 | KΩ | 3W |
| R59 | 1.2 | KΩ | 1W |
| R60 | 7.5 | KΩ | 3W |
| R61 | 1 | KΩ | ½W |
| R62 | 27 | KΩ | ½W |
| R63 | 470 | KΩ | ½W |
| R64 | 2.2 | MΩ | pot. |
| R65 | .33 | MΩ | 1W |
| R66 | 1 | MΩ | ½W |
| R67 | 33 | KΩ | ½W |
| R68 | 8.2 | MΩ | ½W |
| R69 | .22 | MΩ | ½W |
| R70 | 3.3 | MΩ | ½W |
| R71 | 4.7 | MΩ | ½W |
| R72 | 2.2 | MΩ | 1W |
| R73 | 2.2 | MΩ | ½W |
| R74 | 1 | MΩ | pot. |
| R75 | 10 | KΩ | 1W |
| R76 | 1 | MΩ | ½W |
| R77 | 27 | KΩ | 1W |
| R78 | 18 | KΩ | ½W |
| R79 | 8.2 | KΩ | ½W |
| R80 | 1 | MΩ | pot. |
| R81 | .22 | MΩ | ½W |
| R82 | 22 | KΩ | ½W |
| R83 | 470 | Ω | ½W |
| R84 | .47 | MΩ | ½W |
| R85 | 1.2 | MΩ | ½W |
| R86 | 1.5 | MΩ | ½W |
| R87 | 82 | KΩ | ½W |
| R88 | .12 | MΩ | ½W |
| R89 | .5 | MΩ | pot. |
| R90 | .33 | MΩ | ½W |
| R91 | .33 | MΩ | ½W |
| R92 | 5.6 | MΩ | ½W |
| R93 | 0.1 | MΩ | ½W |
| R94 | 4.7 | KΩ | ½W |
| R95 | .15 | MΩ | ½W |
| R96 | 47 | KΩ | 1W |
| R97 | 56 | KΩ | 1W |
| R98 | .15 | MΩ | ½W |
| R99 | 15 | KΩ | ½W |
| R100 | 33 | KΩ | ½W |
| R101 | 1 | MΩ | ½W |
| R102 | 33 | KΩ | ½W |
| R103 | 56 | KΩ | ½W |
| R104 | 180 | KΩ | ½W |
| R105 | 3.3 | KΩ | ½W |
| R106 | 5.6 | KΩ | ½W |
| R107 | 8.2 | KΩ | 1W |
| R108 | 82 | Ω | ½W |
| R109 | 4.7 | KΩ | ½W |
| R110 | .56 | MΩ | ½W |
| R111 | .56 | MΩ | ½W |
| R112 | .39 | MΩ | ½W |
| R113 | 470 | Ω | ½W |
| R114 | 5 | KΩ | pot. |
| R115 | 33 | KΩ | 1W |
| R116 | 56 | KΩ | 1W |
| R117 | 5.6 | MΩ | ½W |
| R118 | .47 | MΩ | ½W |
| R119 | 1 | KΩ | ½W |
| R120 | 3 | KΩ | 3W |

## CAPACITORS

| | | | |
|---|---|---|---|
| C1 | 100 μF | 250 | V |
| C2 | 100 μF | 250 | V |
| C3 | 50 μF | 250 | V |
| C4 | 50 μF | 250 | V |
| C5 | 50 μF | 250 | V |
| C6 | 50 μF | 250 | V |
| C7 | 18 pF | | |
| C8 | 150 pF | | |
| C9 | 1500 pF | | |
| C10 | 47 pF | | |
| C11 | 4.7 pF | | |
| C12 | 47 pF | | |
| C13 | 150 pF | | |
| C14 | 1500 pF | | |
| C15 | 27 pF | | |
| C16 | 1500 pF | | |
| C17 | 82 pF | | |
| C18 | 330 pF | | |
| C19 | 330 pF | | |
| C20 | 3.2 μF | | |
| C21 | .01 μF | | |
| C22 | .1 μF | | |
| C23 | .01 μF | | |
| C24 | 25 μF | | |
| C25 | .001 μF | | |
| C26 | 1500 pF | | |
| C27 | 5 pF | | |
| C28 | 68 pF | | |
| C29 | 68 pF | | |
| C30 | 5 pF | | |
| C31 | 1.8 pF | | |
| C32 | 820 pF | | |
| C33 | 2.5 pF | | |
| C34 | 820 pF | | |
| C35 | 820 pF | | |
| C36 | 2.5 pF | | |
| C37 | 47 pF | | |
| C38 | 820 pF | | |
| C39 | 15 pF | | |
| C40 | Fine tune | | |
| C41 | 2.2 pF | | |
| C42 | 820 pF | | |
| C43 | 150 pF | | |
| C44 | 2.2 pF | | |
| C45 | 8.2 pF | | |
| C46 | 1500 pF | | |
| C47 | 1500 pF | | |
| C48 | 1500 pF | | |
| C49 | 8.2 pF | | |
| C50 | 2.2 pF | | |
| C51 | 150 pF | | |
| C52 | 1500 pF | | |
| C53 | 1500 pF | | |
| C54 | 150 pF | | |
| C55 | 8.2 pF | | |
| C56 | 1.2 pF | | |
| C57 | 1500 pF | | |
| C58 | 150 pF | | |
| C59 | 8.2 pF | | |
| C60 | 1.8 pF | | |
| C61 | 1500 pF | | |
| C62 | 1500 pF | | |
| C63 | 1500 pF | | |
| C64 | 1500 pF | | |
| C65 | 8.2 pF | | |
| C66 | 2.2 pF | | |
| C67 | 150 pF | | |
| C68 | 12 pF | | |
| C69 | 10 pF | | |
| C70 | 1500 pF | | |
| C71 | .027 μF | | |
| C72 | 1 μF | | |
| C73 | 1500 pF. | | |
| C74 | 470 μF | | |
| C75 | 1500 pF | | |
| C76 | .1 μF | | |
| C77 | .033 μF | | |
| C78 | .001 μF | | |
| C79 | .022 μF | | |
| C80 | .015 μF | | |
| C81 | .1 μF | | |
| C82 | .033 μF | | |
| C83 | .0022 μF | | |
| C84 | 100 μF | | |
| C85 | .027 μF | | |
| C86 | .0027 μF | | |
| C87 | .1 μF | | |
| C88 | 8 μF | 25 | V |
| C89 | 270 pF | | |
| C90 | .5 μF | | |
| C91 | .1 μF | | |
| C92 | 150 pF | | |
| C93 | .001 μF | | |
| C94 | 150 pF | | |
| C95 | 470 pF | | |
| C96 | 150 pF | | |
| C97 | 1500 pF | | |
| C98 | 1500 pF | | |
| C99 | .001 μF | | |
| C100 | .1 μF | | |
| C101 | 820 pF | | |
| C102 | 100 pF | | |
| C103 | 1500 pF | | |
| C104 | .0033 μF | | |
| C105 | .056 μF | | |

## VALVES

| | | |
|---|---|---|
| V1 | cascode R.F. triode | 6CW7 |
| V2 | oscillator mixer | 6BL8 |
| V3 | intercarrier sound | |
| V4 | I.F. amplifiers | 6BX6 |
| V5 | audio amplifier and audio output | 6BM8 |
| V6 | vision I.F. | |
| V7 | | |
| V8 | amplifiers | 6BX6 |
| V9 | | |
| V10 | video amplifier and video output | 6BL8 |
| V11 | A.G.C. amplifier and noise inverter | 6BL8 |
| V12 | sync separater and sync phase splitter | 6BL8 |
| V13 | sync phase detector | 6AL5 |
| V14 | horizontal control and oscillator | 6BL8 |
| V15 | horizontal output | 6CM5 |
| V16 | booster diode | 6R3 |
| V17 | E.H.T. rectifier | 1S2 |
| V18 | sync amplifier, part frame multivibrator | 6BL8 |
| V19 | frame output, part frame multivibrator | 6BM8 |
| V20 | power rectifiers | 6N3 |
| V21 | | |

## OTHER COMPONENTS

| | | |
|---|---|---|
| L1 | choke, H.T. 3H | 300 mA |
| L2 | choke, H.T. 6H | 60 mA |
| L3, L4 | sound I.F. transformer | |
| L5 | choke, R.F. | 400 μH |
| L6, L7 | sound I.F. transformer | |
| L8, L9, L10 | ratio transformer | |
| L11 to L21 | coils in tuner | |
| L22 | sound trap | 30.6 Mc/s |
| L23 | coupling coil | 33.5 Mc/s |
| L24 | trap inductor | 29.0 Mc/s |
| L25 | coupling coil | 32.75 Mc/s |
| L26 | trap inductor | 28.4 Mc/s |
| L27 | coupling coil | 31.3 Mc/s |
| L28 | trap inductor | 37.5 Mc/s |
| L29 | coupling coil | 35.8 Mc/s |
| L30 | trap inductor | 38.0 Mc/s |
| L31 | coupling coil | 34.2 Mc/s |
| L32 | choke, R.F. | 130 μH |
| L33 | trap inductor | 5.5 Mc/s |
| L34 | choke, R.F. | 80 μH |
| L35 | oscillator | 15.625 c/s |
| L36 | width coil | |
| L37 | linearity control coil | |

in its load, but has full Gm so that the gain is 11.25 times.

Stage 4 has full conductance but only $\frac{1}{2}$ pF total capacity so that gain is 16.83 times.

The total gain is therefore, 19,300 times.

Consideration must be given to the required trap effects. One trap at 30.6 Mc/s is coupled to the input of the group and does not belong to this part of the discussion. The trap circuits may be easily constructed with Qs of 70, and 8.2 pF is a convenient tuning capacitor value.

Traps are required at 29 Mc/s and 37.5 Mc/s to attenuate possible carriers in adjacent channels. For best effect these are coupled to the 32.54 Mc/s and 33.81 Mc/s circuits respectively, the coupling capacitors being 1.8 pF and 2.2 pF in each case.

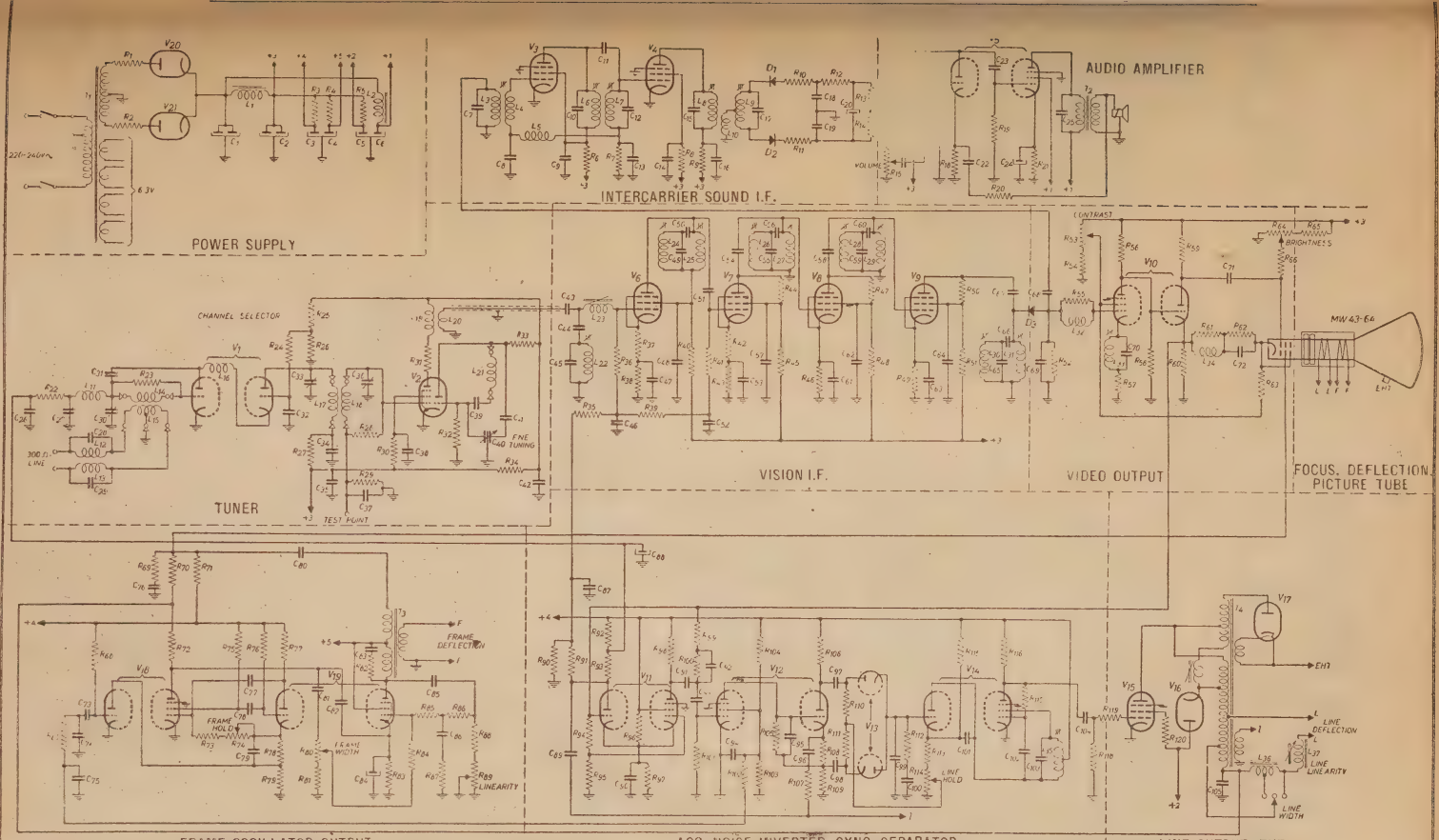
A trap at 33 Mc/s was coupled to the 31.16 Mc/s circuit with 2.2 pF, and another, tuned to 28.4 Mc/s, was coupled to the 31.19 Mc/s circuit with 1.2 pF. While these traps had the desired effects at their respective resonant frequencies, they produced attenuation effects in the passband.

To restore the correct shape to the passband, two of the stagger frequencies were altered slightly and new bandwidths increased.

In addition to correcting the ... band space these changes and the extra capacities added by the ... reduced the stage gains to an ...

(Continued on Page 51)

The above parts list and the cir... opposite were reproduced from ... Philips publication describing ... range of receiving valves and pic... tubes for Australian Television Recei...




The circuit is divided into sections for ease of reference. It is capable of giving excellent results in fringe areas and some sections could conceivably be simplified for use in regions where the signals are consistently of average to good strength. The picture tube may be type MW43-64 with aluminised screen. The parts list appears on the facing page.

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ulated figure of 6800 times.
ith an input capacity of 16.5 pF
he detector circuit, a signal of
volts rms modulated 30 pc is re-
ed to produce three volts rms
he picture tube. This level would
efore, require an input signal of
roximately 100 microvolts at the
grid of the staggered group.
s an alternative to the above de-
, three stages bandpass couplec
only one trap (for the sound
ier plateau) might be considered.
h a group has a gain of about
) times and would, therefore, re-
e an input level of 350 micro-
s for standard output. The over
sensitivity with a tuner gain of
should, therefore, be about 9
rovolts.
his is well worth consideration
he added production difficulties
sed by the use of bandpass trans-
ners can be tolerated.

## EO AMPLIFIER

or convenience the diode vision
ector has been included in this
of the description.
he vision diode has a load circuit
3900 ohms shunted by a 10 pF
acitor plus additional strays. The
eo ampliner pentode grid is DC
pled through a 130 microhenry
es peaking inductor shunted by a
) ohm resistor to prevent ringing
cts.
ne polarity of the diode gives a
ative DC output with negative-
g pulses, so that under no-signal
ditions the pentode has bias de-
ped only from contact potential,
developed from rectified set noise,
a small amount produced by the
stance in the cathode circuit. No
restoration is needed at any point.
lso included in the cathode circuit
the pentode is a rejector circuit
ed to 5.5 M/cs. This attenuates
intercarrier beat signal in the
eo.
he pentode plate, being direct
pled to the cathode follower grid.
ains the DC components.
t this point the sync pulses are
itive going, and this phase
ds for the cathode follower out-
. It is, therefore, correct for coup-
g to the cathode of the picture
e.
ontrast control is obtained by
ying the screen potential of the
tode. Perhaps contrary to expec-
on, this has little effect on the
eo stage gain. The impedance be-
en screen and earth, even with-
bypassing, is not great enough
cause any substantial screen feed-
k.

## CONDARY EFFECT

he reduction of plate current by
ering of the screen has little
ct on the slope of the pentode
r zero grid bias. Contrast change
urs by a secondary effect opera-
g through the AGC system.
he cathode follower output is
pled to the picture tube by means
a series peaking network. Since
effect of AGC is to clamp the
se tops at a constant level, the
ck level can change for different
nal amplitudes, since the pulse
ght would vary.
his is compensated by means of
DC potential divider between the
tode screen and the triode
node. This is quite effective in its
ect. The portion of the divider
ween the picture tube cathode
the signal output must, of course,
bypassed for vision signals.

Under no-signal conditions and contrast turned to maximum, the pentode grid is at about minus 1 volt and the video output cathode about plus 35 volts.

The AGC triode (VII) has a cathode bias of about 105 volts, and with the flyback pulse amplitude applied to the plate (200 volts positive peak), plate current does not flow unless the grid is at about plus 95 volts or higher during the time when the plate pulse is applied.

It is clear that a large signal pulse amplitude must appear at the video cathode before the AGC starts to function. Once the AGC threshold has been passed, however, the AGC action is so effective that it is impossible to saturate the video stage.

From threshold of AGC to very heavy input signal conditions there is less than 2 db rise in video signal amplitude.

At minimum contrast setting and no-signal, the cathode of the video output (and hence the voltage at the AGC grid) has a value of 88-90 volts. Obviously, with such a small margin between effective bias and cut-off, the signal amplitude at the video cathode need only reach a small value before AGC threshold is reached, after which the signal is effectively held to this value. In fact, no measurable increase can be observed between threshold and heavy signal conditions.

With regard to a design for a cheap receiver, there is the possibility of using the pentode portion of the 6BL8 without cathode follower. In this instance, the shunt capacity loading now effective at the pentode plate would reduce the stage gain to about 12 or 15 at most. Retention of the 6BL8, however, would leave the triode available for some other function in an economy design.

## SOUND I.F. CHANNEL

The I.F. channel for intercarrier sound uses two tubes, type 6BX6.

The first tube operates as a normal amplifier, but the second operates with low plate and screen voltage. There is a short time constant network in the grid return, and no cathode-bias is used. Under such conditions the tube will limit by grid rectification and have a relatively low stage gain and low maximum output voltage.

The short time constant in the grid return ensures that the low frequency potentials appearing at this point will follow rapid changes in the carrier level. These potentials are applied to the first I.F. grid by means of a choke capacity filter, in order to retain the rapidity of action.

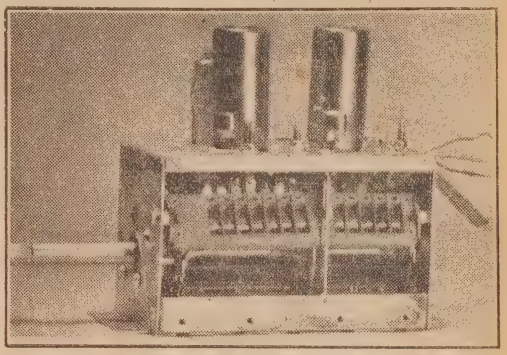
The whole amplifier, by virtue of its higher gain, has more effective A.V.C. action, and much better envelope feedback properties than a one-stage channel.

Against these improvements, the extra cost of the additional stage is moderate. In the two-stage design the coils are easier to make. The bandwidth is wider, but this is of significance only if the transmitting stations fail to observe their frequency tolerances or circuit component values drift.

In a better quality set, the two-stage channel merits inclusion mainly because of its better A.M. rejection, A.V.C. properties and higher gain.

With regard to this gain, there is no doubt that the sensitivity of the channel is considerably in excess of needs. The poorest beat signal from a standard level video signal at the vision diode is enough to drive the A.F. amplifier to full output.

At the same time, the maximum A.F. output is not large enough to excite a high slope output pentode directly without a preamplifier.



A typical turret type tuner, as used in the receiver described in these columns. It is, in fact, a complete "front end", which receives the input signal from the aerial transmission line and delivers the requisite output to the first IF amplifier.

## RATIO DETECTOR

The performance of the ratio detector is linked with that of the sound I.F. amplifier already described. The input transformer is somewhat easier to make, and has a wider bandwidth than that used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e circuit of a single stage chan-

e diode efficiency is degenerated
tly by the use of series resistors,
his limits spread in performance
es while still retaining a good
ll design.
erall A.M. rejection is so high
ven moderate signals that it is
practicable to measure it.

## ND AMPLIFIER

single 6BM8 is used in this
on.
e sensitivity and power output
ty of this amplifier compare
ably with those of a typical
sound receiver. The amplifier
give a satisfactory perform-
from any good quality pick-up
casional duty of this kind were
ed.
such use is excluded, however,
amplifier may be less sensitive
the two-stage sound I.F. is
This gives an opportunity to
ove the quality still further by
er feedback, with possibly some
component economy.

## ED A.G.C. AND SE INVERTER

though these functions may be
rmed quite independently, they
grouped because they are in-
d in the one tube envelope V11,
e 6BL8.
designing the circuit it should
alised that the average current
e tube is small, rarely exceeding
A. It is therefore possible
the cathode potential by means
voltage divider, consuming at
1 or 2 mA.
e cathode potential should be
ed in relation to the potential
ne cathode of the video output
to which the A.G.C. triode grid
upled.
ising the A.G.C. tube cathode
he effect of permitting a larger
amplitude to build up before
C. threshold occurs. This, though
ay give greater contrast at maxi-
, will cause some loss of con-
control action on signals of good
gth, if carried to excess, and in
me cases produce overload
ts in the picture.
e A.G.C. tube, since it has large
s of short duration applied to
plate, can cause interference by
electrode effects with other
tions carried in the same en-
pe.
is precludes the use of a double
in most cases, the only im-
nt exception being a noise in-
r. This arrangement has been
ted in the sample receiver.

## NTROL VOLTAGE

ne A.G.C. voltage is applied to
cascode R.F. amplifier and the
two vision I.F. amplifiers. In
r to give the best signal-to-noise
on weak signals, the voltage
ied to the cascode is delayed by
ns of a potentiometer network
the H.T. line. The delay is
t 2 volts.
may appear from the circuit
ram that this will give positive
on the cascode grid, but a high
tance (1 megohm) in series with
rid completely protects the tube.
ter the delay has been exceeded
t 90 pc or more of the A.G.C.
ge is applied to the cascode to
ect the mixer from overload on
g signals.
delay exists in the line to the


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6BX6 grids, but this voltage is tapped down to about 50 pc. This is to balance the A.G.C. system on strong signal inputs to avoid overload of either mixer or second I.F.

The noise inverter also takes very little current and may therefore have the cathode potential stabilised by the same network as the A.G.C. tube. Effective plate-to-cathode and screen-to-cathode voltages are both about 100 volts. Under these conditions the control grid, if at the same level as the A.G.C. tube grid, is a little further beyond cut-off.

Since the A.G.C. tube virtually clamps the pulse tops near its cut-off potential, these tops will still be below cut-off at the inverter tube grid.

The only voltage to cause this tube to conduct are noise pulses exceeding the cut-off point. These noise pulses are thus separated and amplified, appearing at the plate in opposite polarity and with greater amplitude than in the original composite signal. The inverted pulses are added to the signal applied to the sync separator.

They more than cancel the original positive-going pulses, but any surplus negatively-going pulse does not affect the satisfactory operation of the sync separator.

## LINE OSCILLATOR

This part of the receiver includes the oscillator tube, which provides the drive for the line output pentode the reactance tube (which is the means of changing the oscillator frequency), the phase detector (which controls the reactance tube) and the phase splitter (which supplies the input signals to the phase detector).

The oscillator, which is the pentode portion of V14, a type 6BL8 tube, is operated in a class C Hartley circuit with tight coupling. The oscillation is produced between the control grid and the screen grid, while the plate is loaded to provide the output signal.

Since the oscillator coupling is tight, the angle of flow of the plate current is small, and voltage pulses of short duration are produced. These have suitable shape and sufficient amplitude (about 140 volts peak to peak) to drive the line output pentode without further correction.

The oscillator grid leak is connected back to the plate to prevent squegging.

The reactance tube is in parallel with the greater part of the tuned circuit and the amount of frequency control exercised is a function of the tube mutual conductance. This conductance may be controlled by returning the grid to a tap on the cathode resistor.

This takes the form of a potentiometer and functions as the "line hold" control.

For the purpose of providing automatic frequency control, the D.C. voltage output from a phase detector is connected between the grid and the potentiometer tap.

## PHASE DETECTOR

The phase detector, which is a 6AL5 in balanced circuit, compares the relative phase of the sync pulses in the signal and the flyback pulse produced by the line oscillator, and develops a D.C. signal whose value and polarity are functions of the phase difference. It is this D.C. signal which after filtering is applied between the reactance tube and the potentiometer tap.

The sync separator, which is the pentode portion of V12 (type 6BL8) is grid leak biased (time constant 0.01 second), and has the screen voltage stabilised at 45 volts. The plate voltage in the cut-off condition is about 45 volts, as it is derived from the cathode potential of the V12 triode portion.

The grid base is therefore quite short, only —1.5 volts, and sync pulses exceeding this amplitude are completely separated. Line pulse signals appear in the plate circuit with an amplitude of 45 volts, producing in the phase splitter equal plate and cathode voltages of about the same amplitude.

The 150 pf screen bypass minimises screen feedback at line frequency, but allows screen feedback at frame frequency, so that frame signals are quite small in the plate circuit.

However, at the screen the line pulses have an amplitude of about 0.25 volts, while the frame pulse has an amplitude of 1.5 volts.

After the first 33,000 ohms resistor of the integrator network, the corresponding values are 0.06 line and 1.4 volts frame, while after the second the line is unmeasurable and the frame is 1.3 volts.

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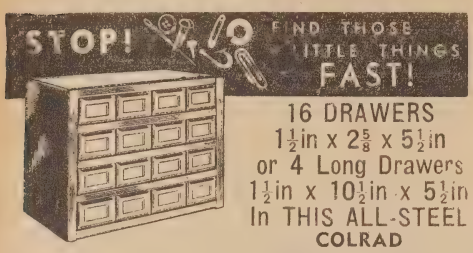


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## EVERYTHING FOR THE RADIO AND ELECTRICAL EXPERIMENTER

The line pulse signals are applied to the phase splitter, which produces late and cathode pulse signals in phase opposition.

The line flyback pulse supplied for phase comparison is differentiated and applied to the cathode of the phase splitter. That portion of the applied voltage which appears across the 82 ohm cathode resistor is in effect applied to the grid, and being amplified in the tube, this signal appears at the plate in the same phase as that at the cathode.

The 82 ohm resistor has been so selected that the flyback pulse at the plate has the same amplitude as appears across the 4,700 ohm cathode resistor.

When the line hold control is correctly set, the phase detector produces no output voltage, but when the control is not at this position a phase difference occurs. The correcting voltage can attain a value as large as eight volts (plus or minus) before line sync is lost. This is equivalent to the system being able to hold against frequency variations, even though its free running frequency may differ from the incoming line pulse frequency by plus or minus 2½ pc.

## NO EFFECT ON SYNC.

If the phase detector is properly balanced, the signal amplitudes, within appreciable limits, have no effect on the accuracy of synchronization. Larger amplitudes produce larger restoring voltages from out-of-phase conditions than do small pulse amplitudes. The control action for large amplitudes is, therefore, more effective than for small.

However, when the line hold control is correctly set, there will always be a restoring voltage available from the phase detector until phase is correct. This is in marked contrast to some forms of coincidence detectors, which, when either pulse amplitude changes and produces a change in the correcting voltage, each stability by virtue of an out-of-phase movement of the line oscillator.

Such action absorbs some of the control range of the circuit with regard to its ability to deal with phase shifts that require correction, and produce small horizontal shifts in the picture.

## LINE OUTPUT AND EHT

The tubes used in this part of the receiver are a 6CM5 as line output tube, 6R3 as booster diode and 6S2 as EHT rectifier

The 6CM5 is used in a manner which is typical of European practice. The tube conducts throughout the whole of the scanning period and the plate voltage assumes low values in operation. The booster diode also conducts during the whole of the scan.

American practice, on the other hand, usually cuts off the pentode during the early part of the scan (till about 40 pc of the scan period has elapsed), during which time the deflection energy is supplied from the booster circuit.

By making both pentode and diode conduct continuously, disturbances during the scan are reduced to a minimum, with improvement of horizontal linearity. Effects due to disturbances could be minimised by extra damping in the circuit, but this wastes power.

The chosen mode of operation, as it requires the pentode to pass plate current at low voltages, calls for relatively large screen grid currents. This has been amply provided for in the 6CM5, which has permissible dissipation of 10 watts for the plate and six watts for the screen.

In typical circuit design, dissipation values appreciably lower than this are common.

The use of Ferroxcube cores in line output transformer and in the deflection yoke contributes substantially to the high efficiency obtained. No difficulty is experienced in securing adequate boost and EHT voltages.

Because of the low losses in the system, flyback has a tendency to promote ringing in a circuit of which the main elements are the leakage inductance of the EHT overwind and the stray (mainly winding) capacity.

If this oscillator "circuit" can be tuned to a frequency suitably related to the flyback fundamental frequency, substantial benefits may be secured.

If, for example, the ringing frequency is tuned to be the third harmonic of the flyback frequency, and suitably phased with the fundamental, a reduction (of the order of 15 pc) in the peak booster voltage may be obtained for a given DC boost voltage.

To secure this effect it is common practice to place the EHT winding on a separate limb of the transformer in order to control the leakage more conveniently.

## CURRENT PEAK

The reduction in peak booster voltage enables a higher DC voltage to be obtained for a given peak limit. This, in turn, reduces the current peak in the pentode plate current.

The third harmonic will appear in the EHT pulse in such phase as to increase the peak value and hence give a higher DC output voltage. This has the added effect of worsening the regulation of the EHT voltage which is not necessarily a bad consequence.

It is possible to use a different mode of tuning (eg, the 5th harmonic), which would give a flatter EHT pulse and a better regulation of the resulting DC output voltage. This, however, would not give the same improvement with regard to the booster peak voltage as that obtained with third harmonic tuning.

Exact third harmonic tuning tends to promote oscillations which persist during the scan period with intolerable amplitudes. To reduce these, the ringing frequency is tuned to a value some 10 pc lower than the third harmonic, correct frequency being that which gives minimum ripple in the booster diode current, rather than that which gives minimum peak booster voltage. The tuning, however, is close to optimum for this effect, also.

In the circuit a separate variable tuning inductor is shown between the booster cathode and the EHT overwind. This method involves tapping the overwind, which may be inconvenient in production. It also


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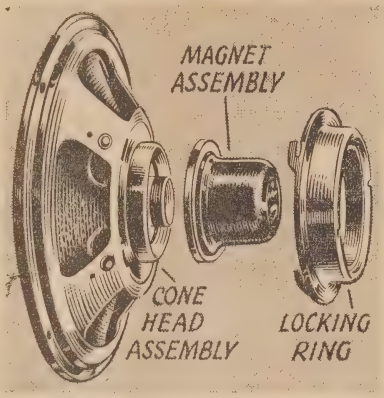


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rs the expense of providing and
lating the tuning inductor The
red tuning effects can be secured
ther methods, including special
gn in the transformer details
by controlling the leakage with
ting straps.

## ME OSCILLATOR

order to trace the course of the
cal deflection signal, it is neces-
to start at the sync separator de-
ed earlier.

e vertical sync pulse, which ap-
s at the screen grid of the sync
rator, is applied to the grid of
triode through an integrating
ork consisting of R102, C75, R67
C74. This triode has a very low
voltage (about 10 volts) and the
pulse is therefore clipped to a
tant level and reversed in phase.

e vertical oscillation is produc-
y a multivibrator consisting of a
pentode section and a V19 tri-
section. In the pentode portion
18 the screen is used in lieu
e plate for the oscillator, and the
ut signal is taken from the pen-
plate.

e to this, variation of the height
ertical linearity controls has a
igible effect on the operation of
multivibrator. This indepen-
e, and the effective elimination
nterference in the sync signal,
ide an exceptional degree of
lity with consequent accurate
lace.

e signal provided by the oscilla-
for the excitation of the output
ode is substantially of sawtooth
e. Since the output transformer
limited primary inductance, a
ary current with a large non-
r component is required for
r deflection coil current.

the pentode cannot produce this
e with a driving voltage avail-
to it, selective feedback is ap-
d to produce the desired effect.

is worth noting that an extra
ling on the vertical output trans-
er provides a blanking pulse for
picture tube during vertical fly-

## POWER SUPPLY

e main B+ power supply is pro-
d by a pair of 6N3 rectifiers op-
ed in full wave circuit.

e mains transformer is designed
a generous core to keep the peak
netic induction well below the
ration value. A limit of 9000 to
00 gauss is suggested as a maxi-
n iron density.

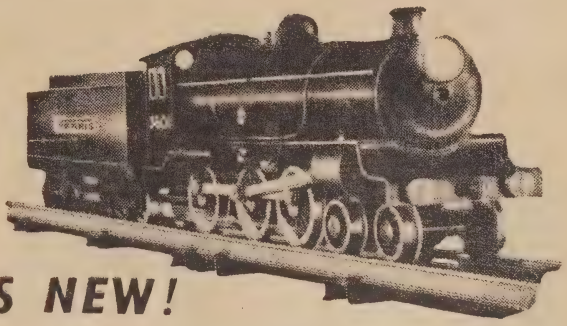
re must be taken at all times to
ent the stray magnetic field from
transformer from interfering
the picture by induction in the
ection unit. Apart from keeping
flux density (and consequently
leakage) low, selection of the
favorable position in the lay-
or the use of heavy copper short-
straps are often effective.

e filter circuits are quite con-
ional in most respects. Since
receiver must be capable of re-
ing signals not synchronised with
mains, filtering needs to be
ough. In this receiver, the sound
is supplied through a separate
e, to keep coupling between
d and vision parts to a minimum.

Editor's Note: Additional circuit
rmation, testing procedure, per-
nance data and valve application
are given in the book from
ch the foregoing article was ex-
ted.)


FERRIS Electric TRAINS

# DEMONSTRATION UNITS GREATLY REDUCED



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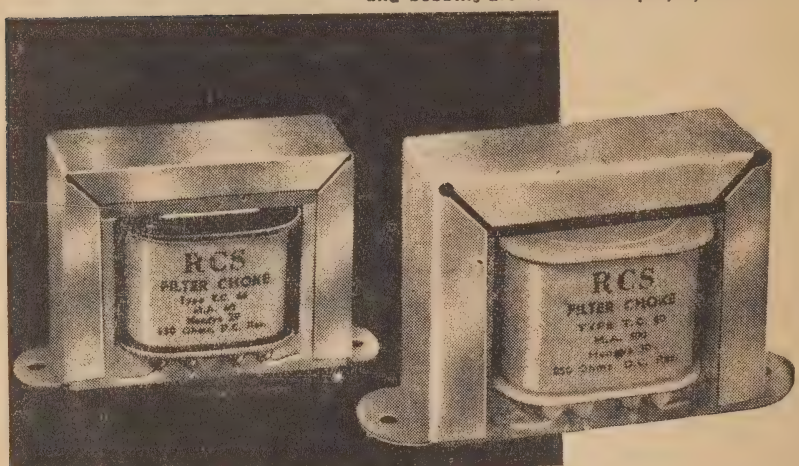
**Here are full details of types available in R.C.S. filter chokes, audio chokes and transformers, filament and auto transformers, speaker transformers and speaker replacement windings. It is suggested that these details be kept for reference. These R.C.S. components are both designed and manufactured in the light of latest findings in the field of electronics. Brackets are of aluminium and bobbins are of moulded polystyrene.**

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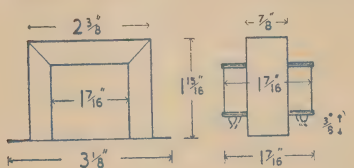
Size: Core Section ¾in x ¾in 10 watts
o/all sizes 2⅜in L x 2in H x 1⅛in W.




### FILTER CHOKES

| | Retail Price |
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| TS 26 P/P Triode | 3500 | 3.9 | 16/- |
| TS 27 Single Pentode | 5000 | 2.3 | 16/- |
| TS 28 Single Pentode | 5000 | 3.9 | 16/- |
| TS 29 P/P Pentode | 5000 | 2.3 | 16/- |
| TS 30 P/P Pentode | 5000 | 3.9 | 16/- |

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| F 133 Single Triode | 3500 | 3.9 | 7/- |
| F 134 P/P Triode | 3500 | 2.3 | 7/- |
| F 135 P/P Triode | 3500 | 3.9 | 7/- |
| F 136 Single Pentode | 5000 | 2.3 | 7/- |
| F 137 Single Pentode | 5000 | 3.9 | 7/- |
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## CHOKES AND TRANSFORMERS

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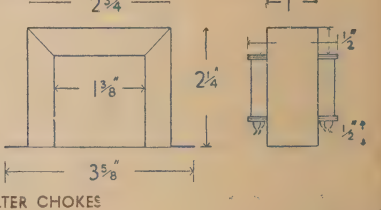


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|---|---|
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| TC 70 75 M/A 50 H | 18/- |
| TC 65 50 M/A 30 H | 16/4 |
| TC 58 L/T 3 amp 50 M/H Vib. | 17/6 |

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| | |
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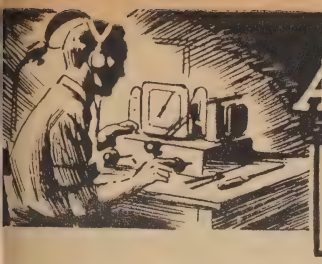
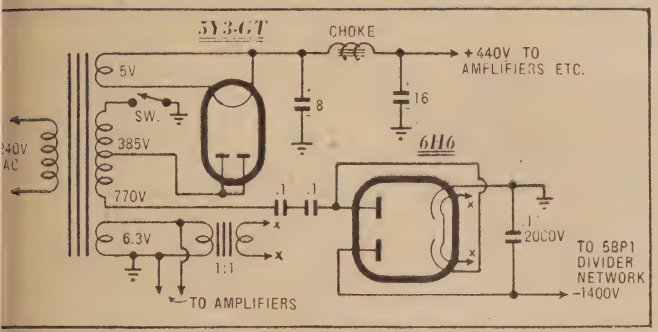


# A READER BUILT IT!

**Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.**

## A SIMPLE EHT SUPPLY FOR A CRO

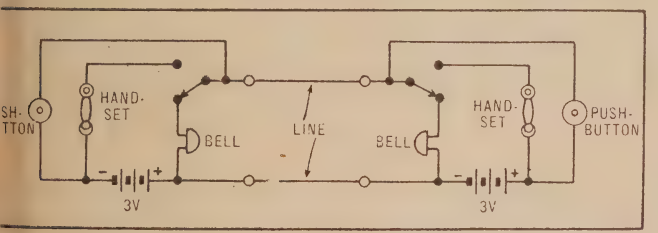



HERE is a simple way of supplying the HT and EHT for the ordinary 5in CRT. The transformer is an ordinary 385v CT, 385v type, which as most experimenters have in their 'junk box'.

I found that if the tube (a 5BP1) is shielded with the normal metal shield, and the transformer placed at the back of the chassis about 8in below the tube socket, there was no magnetic defocusing effect. The only special component is the 2000v 1.0 uf filter condenser.

"The HT was about 440v and the EHT 1400v. As the heater has to be at a high potential (1400v), I wound a small transformer using the iron from an old loudspeaker transformer. The turns ratio was 1:1 and the primary was supplied by the 6.3v winding on the power transformer. The insulation must of course, be very good."—(K. Boland, 19 Celia St., BURWOOD, E.13, Vic.).

## A HOME-MADE TELEPHONE SYSTEM




HERE is a two-way telephone system employing only two wires between stations, with a push-button bell or buzzer calling facility.

The handsets can be ex-disposal field-telephone sets or made, as mine were, out of a low impedance headphone and an old carbon mike.

My bells are, at one end an ex-disposal Army type, at the other a home made one using a bell from an old alarm clock.

The switches, operated by lifting or replacing the handset, can be old MG automatic switches or home-made ones as mine are, using dial-bell springs and small strips of metal to make contact.

Two sets of No. 6 Type Batteries are used, 3 volts at each station. To call the handset is lifted and the switch goes into position 1. Then the button is pushed and as the bell in the other station rings the "tone" can be heard in the caller's earphone.

"Not until the second handset in the other station is lifted can communications by speech be made. Naturally, when both handsets are replaced all current flow is cut off from the batteries.

"Any number of stations may be set up using this system, identifying the required called station by code—or they can be controlled from a central switchboard." (R. Patterson, Box 10, URBENVILLE, NSW.)

## HOW TO SOLDER ALUMINIUM

**A reader from Hartwell, Victoria, has some suggestions to make about soldering aluminium. He writes as follows:**

"IN the Answers to Correspondents in the November, 1955 issue, J.V.Z., of Nudley, Q., asks for information on soldering aluminium. I am enclosing two samples of methods of joining aluminium which may be of interest." (Samples enclosed.—Ed.).

"The light gauge joint was made with a material called 'Solderlum' made by John Arthur Industries, 5 Dorset Rd., Northbridge, NSW. This has a higher melting point than 50/50 tin-lead solder, but handles easily on aluminium.

"The T-piece made from 3-16" sheet has been brazed. This method of joining is very simple provided a little care is taken.

"The joint surfaces are coated with Aluminium Brazing Flux and heated with a blow lamp, gas-air torch, or on the gas stove (provided the wife is missing) till the flux just melts. 10% Silicon-Aluminium filler rod is then rubbed on the hot surface (exactly as in brazing steel) and this will quickly melt and flow into the joint.

"Once the joint has been made, it is not easily broken by reheating, as the silicon diffuses from the joint into the parent metal on each side giving a continuous alloy.

"The only difficulty is to see that too much heat is not applied, otherwise you will be left with a pool of molten aluminium. This happened to me the first time I tried. I had been given the wrong flux, and the aluminium melted long before the flux did. The correct temperature is one where the flux just melts and flows freely—corresponding to a dull red in the dark.

"Both the Aluminium Brazing Flux and the Filler rod (1-16in—10% Silicon-Aluminium) are available quite cheaply from Commonwealth Industrial Gases or their agents, and they can also supply further information on the process. The Aluminium Company of Canada put out a very good book on the subject, it's not available in the shops, but there is usually a copy in the library of any Technical College.

"Incidentally an oxy-acetylene welding torch cannot be used as the heat is too concentrated—the whole area surrounding the joint must be heated. I have used both these processes in fabricating a 35mm slide projector from sheet and plate aluminium, and have struck no difficulties."—(A. M. Fowler, 19 Hartwell Hill Rd., HARTWELL, E.6, Vic.)

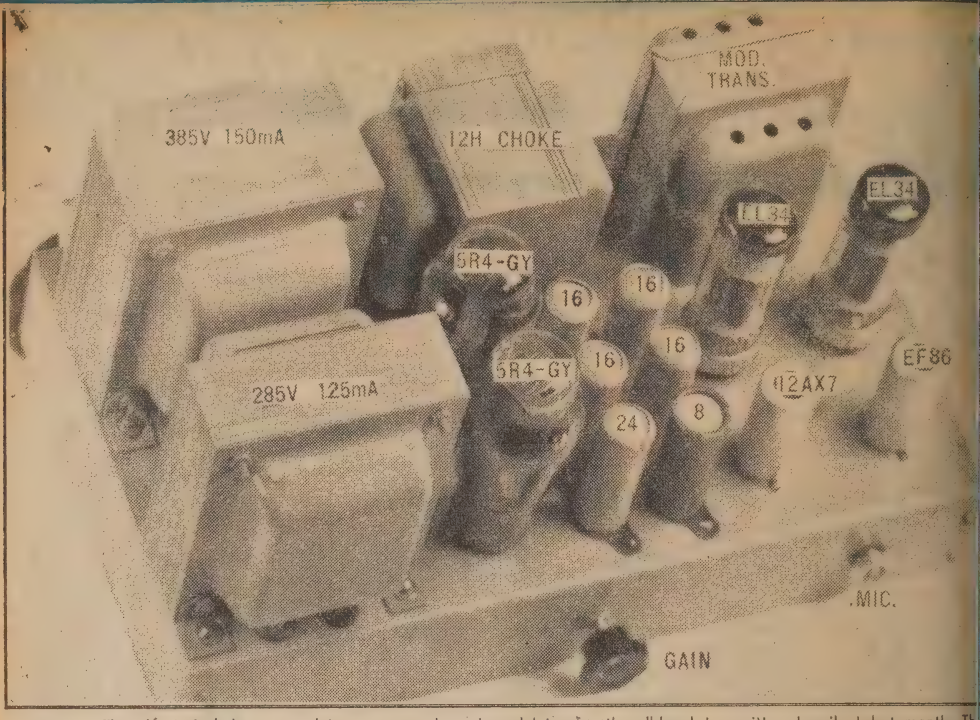



Figure 1. This chassis includes a complete power supply and modulator for the all-band transmitter described last month. Th is plenty of room for all items and you should have no difficulty in fitting equivalent components in other brands. Switching done in the transmitter chassis via a connecting cable.

# MODULATOR AND POWER SUPPL

**A companion unit to the all-band amateur transmitter described last month, our new modulator and power supply introduces some new ideas calculated to give you a powerful complete amateur station at low cost. As with the transmitter, the basic design lends itself to modifications or additions, according to the parts on hand, or you can copy our published design in every detail with confidence.**

by Maurice Findlay

THE transmitter described last month was constructed on a 14in chassis with a 15in wide front panel, a size we decided to adopt some time ago as an alternative, in the case of small equipments, to the standard 19in panel.

The modulator also appears on the same size chassis. If desired a 15in panel can be fitted and the two units mounted one above the other in a rack.

There is a lot to be said for mounting the transmitter in an enclosed metal table cabinet to be placed on the operating table alongside the receiver. The modulator and power supply, heavy items which do not frequently require adjustment, can then easily be stored under the table or somewhere out of the way.

Our suggestion re the cabinet is tied up with the matter of interference to TV receivers, which will soon be making their appearance.

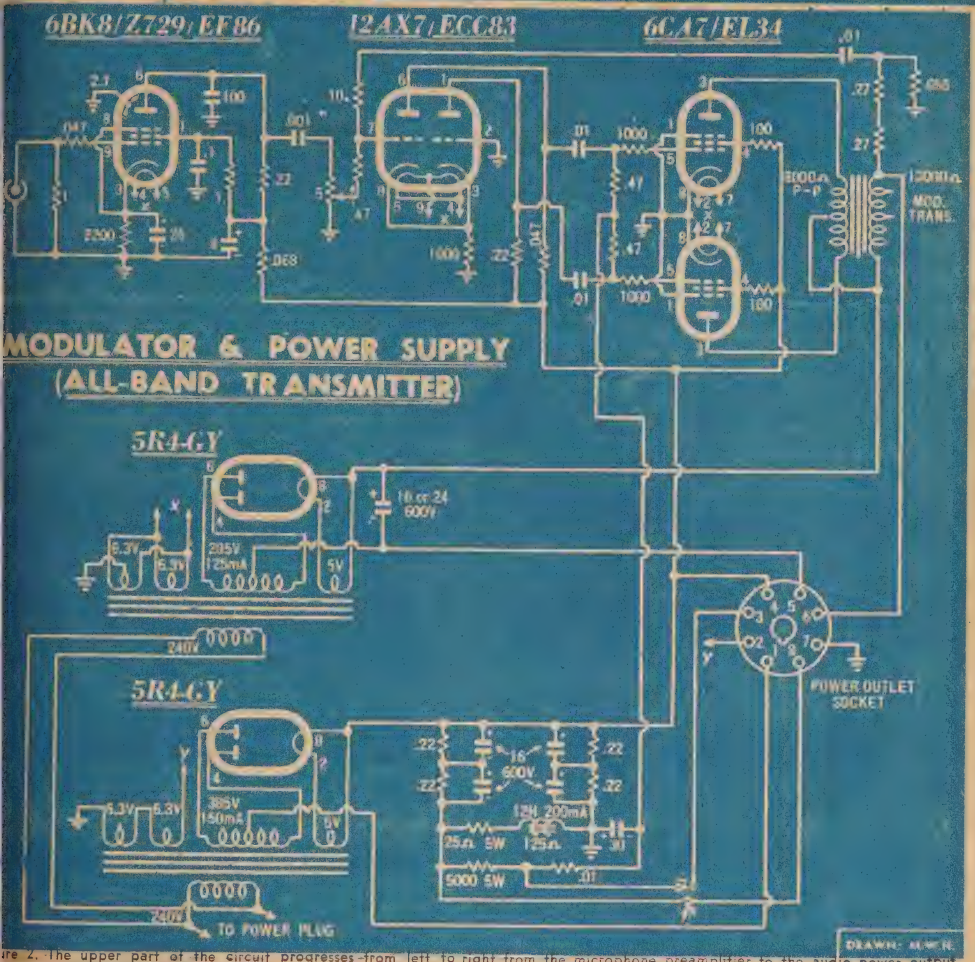
Undoubtedly, amateur transmitters will have to conform to new standards in the matter of spurious radiation—a television receiver with its wide bandwidth, high gain and depending on short duration synchronising signals is a particu vulnerable device.

The basic techniques for elim ing television interference are sh ing and filtering and obvious metal cabinet is a good start. many cases the cabinet alone make the difference between s factory and unsatisfactory perf ance.

With this transmitter we hav taken any special circuit precau against TVI. The various filters shielding add appreciably to complication of the transmitter while the problem is not immed most readers, we feel, would be to avoid the extra complic initially.

Besides, with no regular transmissions as yet, we have n portunity of determining the e

# OVEL IDEAS IN NEW MODULATOR AND POWER UNIT




re 2. The upper part of the circuit progresses from left to right from the microphone preamplifier to the audio power output es while the lower part is a combination 600V and 400V power supply for both the above modulator and the transmitter des- ed last month. The input sensitivity of the mic. preamp. for full output is approx. 20 mV so that types other than the crystal microphone normally intended could be used

ss of such filters in order to on firm recommendations.

e multi-band tank circuit may be replaced later by a pi- er, which tends to attenuate onic radiation, in a TVI proof- ansmitter but this is an alter- e which could be incorporated mostly the same tuning com- nts. In the meantime, the multi- circuit certainly makes for nience.

much for the above as general round. The immediate discus- is centred around the power y and modulator design.

logical approach to the de- f a power supply is to total up e currents of the various items: tor, buffer amplifiers, final fier, modulator power valves oltage amplifiers, &c., associated with the modulator. In allotting current to each item consideration should be given to the maximum current likely to be encountered under special tuning conditions.

If the modulator is operated under class AB or class B conditions, the current without modulation is less than with modulation. For speech conditions the average current considered over a period of minutes is only a little higher than the minimum current without modulation, so that it is perfectly in order to allow less than the maximum current at full modulation in the calculation.

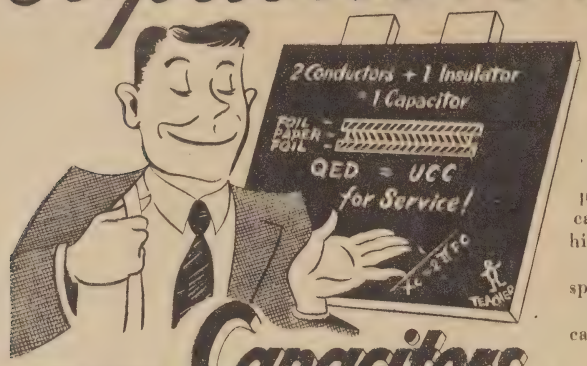
Having arrived at a figure for maximum current and knowing the voltages required, the designer is then in a position to choose the rectifier valve or valves.

That the total current on the peaks of modulation exceeds the ratings of the rectifier valve may not be important because the capacitors in the power supply act as a reservoir and also the rectifier is rated to handle short duration peaks of current considerably in excess of the average.

The next item for consideration is the power transformer or transformers. The published data on the rectifier valves will give you a fairly close estimate of the voltage required and the current has already been calculated. From there you can go to a transformer manufacturer's catalogue and pick out the transformer in his range nearest to your requirements.

If he doesn't happen to make a suitable transformer and you can afford the cost, you can ask him to

# Capacitors are simple—

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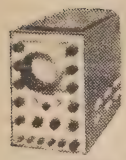
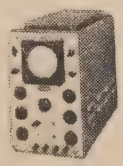


CD 514



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T.B. Trigger Sensitivity: 1 v. R.M.S., minimum.
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Dr. Frittertime

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up a special transformer to specifications.

re we come to the important in the discussion. Published former ratings are worked out e basis of continuous operation the object of keeping the tem- ure below that likely to dam- ne insulating materials.

se materials may be cotton, varnish, &c., and generally t be heated above 105 degrees grade (a little above the boil- emperature of water) without ge.

## TEMPERATURE

copper and iron making up indings and core of the trans- r can, of course, be heated to much higher temperatures be- their characteristics change cally. so that they need not nsidered at the moment.

wever, a transformer, run at nanufacturer's full rating may in hour, two hours or more de- ng on its size to approach its temperature.

then, the transformer is only n for 15 minutes or so at the and switched off, it will never ear the maximum temperature. other words you can pay out money for iron, copper and in- ng paper that you never really good use.

he exact operating conditions e transformer could be speci- it would be a fairly simple to determine the size re- l.

example, a transmitter may ed for some beacon service it is switched on for one and switched off for two sec- It may be known also that urrounding temperature will exceed 30 degrees. Either xperiment or calculation the um transformer for the job e determined.

he case of an amateur trans- the conditions are not so defined and it isn't easy to at a calculated solution. Last we suggested 50 pc of the ing time with a maximum period of 15 minutes as a able basis, but others may dif-

## MENT NEEDED

transformer engineer we dis- the subject with was of the n that any Ham who exceed- e above ratings showed very anners and deserved his trans- rs to blow up in any case!

wever, it isn't possible to be matic as this and every allow- or the most unfavorable oper- conditions for the transformers oe made. In the final analysis, ore, the judgment of the de- is a big factor which cannot passed by the most lengthy ations.

operate the 6146 valve of last 's transmitter at its maximum s and operate a modulator as ve require a power supply to r about 50 mA maximum at olts and about 170 mA at 600

ecial high voltage transformer be used but it is cheaper to pair of ordinary receiver type transformers to make up two supplies which can be placed

## UNDERNEATH VIEW OF CHASSIS

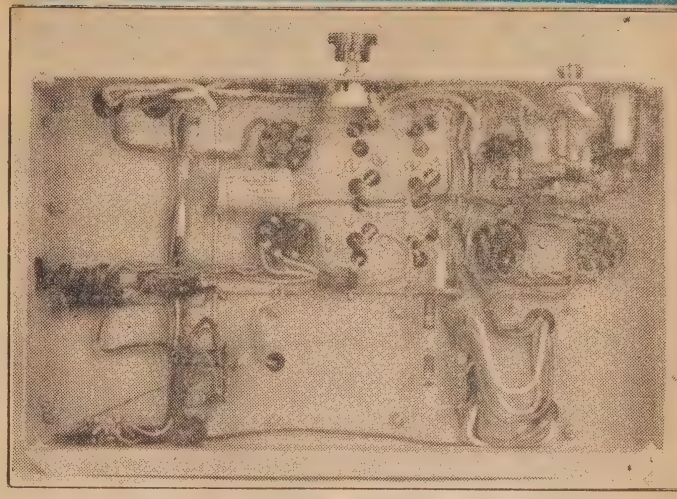

Figure 3. Wiring methods vary with constructors but there should be no difficulty with this unit. A tag strip near the voltage amplifier valves makes for convenient mounting of small components but otherwse no special aids to wiring need to be used.

in series. The transformer at the lower voltage end then has to deliver 220 mA and the other transformer 170 mA.

After consideration and a number of measurements of temperature rise we are of the opinion that these requirements in an amateur transmitter can reasonably be met by transformers rated at 150 mA and 125 mA respectively. This allows for the filament windings of the transformer to be loaded continuously.

## OTHER OPINIONS

We have seen amateur designs where the allowable increases have been very much greater on a percentage basis than the above and at a later date may be prepared to revise our opinion, but at the moment we tend to be a little cautious, particularly as some local transformers have lesser reserve than others and we do not intend to specify any particular brand.

After a morning's work on the laboratory model during which the filaments had been left on and the transmitter operated intermittently for the purpose of making measurements, it was left on continuously for an hour with no modulation and 75 watts input to the 6146. The standing drain of the modulator valves, amounting to about 50 mA, was not removed.

At the end of the test, the temperature of both power transformers was such that a hand could comfortably be placed on them. For the insulation of the transformer to be in danger a much higher temperature would need to have been reached.

The temperature of 105 degrees we mentioned earlier is the temperature inside the transformer at the hottest point. The external temperature of the transformer may be many degrees cooler.

The usual method of measuring the temperature rise is to make a measurement of the resistance at room temperature of a particular winding and then measure the resistance of the winding again hot. Knowing the temperature coefficient of copper, the upper temperature can readily be calculated. Suitable formulae are given in Radiotron Designer's Handbook and other well known reference books.

For the measurements to be reasonably accurate, the resistance should be measured to three significant figures so that the usual simple ohmmeter is not suitable and a bridge is called for.

The results of some tests we carried out with one particular transformer are given here graphically. High tension and filament windings were fully loaded according to the manufacturer's ratings and then spot readings of temperature made every 15 minutes.

When the transformer had cooled to room temperature again conditions were arranged so that the high tension winding only was given a 40 pc overload. The filaments windings were fully loaded all the time, but the high tension winding only for 10 minutes after which it was given a 10 minute "rest". The results of the tests are plotted in Figure 4.

## RECOVERY

The interesting point is that, although the temperature rises quickly during the "on" period it falls quickly during the "rest" period and the final result is that it oscillates about the temperature for normal loading with the transformer operating continuously

It was not until the fourth "on" cycle, or over 1 hour of the tests, that the peak temperature exceeded the maximum temperature on continuous operation.

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ring about 15 degrees for
ot spots inside the trans-
a suitable maximum tem-
e according to the resistance
s becomes 90 degrees so that
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fairly conservatively. This
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being able to rerate a trans-
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## LE.

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ded the high voltage wind-
a centre tap, two high volt-
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would have been necessary
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Geloso VFO

space has been devoted to
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asis before, but the details
remainder of the power
section are also of interest.
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voltage.

## IN NEGATIVE LEAD

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han the positive lead. The
for this is that the voltage
ross the choke, which is un-
le, can be filtered by a high
ce filter and used to supply
the modulator valves.

would have been difficult
passing the current of the
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ough the choke, the best
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s this resistance is closely
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or valves.

apacitor part of the filter is
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tics, a pair being wired in
o make up an effective 8
h side of the choke. Bleeder
are wired across the capaci-
order to equalise the volt-
the case of unequal leakage
es

Since the operating voltage is only about 400 and the supply never likely to be switched on without the class C amplifier and modulator valves drawing some current, a pair of 8 mfd 600 V electrolytics would probably be quite safe. Please yourself on this point.

Current from the smaller of the two power supplies goes only to the plates of the modulators and the plate and screen of the 6146. Elaborate filtering is not required, since these circuits are uncritical of hum and in any case the poorly filtered supply contributes less than half the total high tension.

that the steady drain of the 6146 helps to keep the plate voltage of the EL34's constant when the current increases during modulation. With speech, particularly, the filter capacitors are able to deliver the sharp peaks of current without allowing the high tension voltage to fall appreciably.

The same applies to the screens of the EL34's which are common with the VFO.

Ideally the grid bias for the EL34's should be obtained from either a battery or a special separate bias supply but a more convenient compromise is to provide back-bias. The

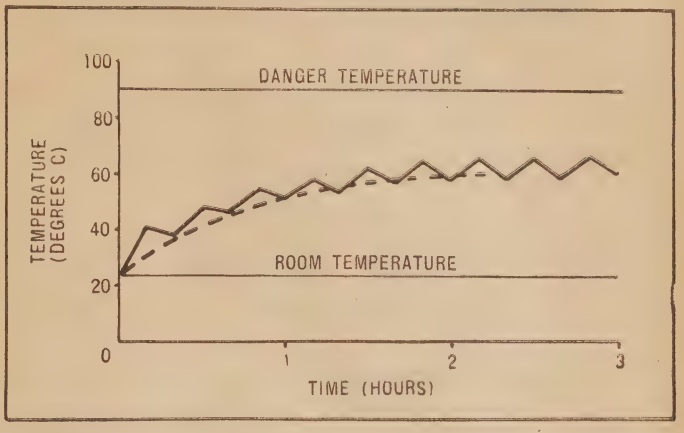


Figure 4. The broken curve shows the rise in temperature with time for a particular transformer operated under normal loading conditions. The temperature of the same transformer with the secondary operated intermittantly but with a 40 pc overload is shown in the solid curve.

On-the-air tests with nearby monitor receivers confirmed that the overall hum level on the carrier is negligible.

For the output valves of the modulator we have chosen the EL34 (or 6AC7 to give its RTMA type number). This type has only recently been introduced but is now in good supply.

The interesting point about the valve is that it can be operated in class B without grid current and deliver enormous amounts of power with high efficiency. Most class B amplifiers draw grid current during some part of the cycle and therefore require some low-impedance drive source, usually coupled through a transformer, to provide a low resistance DC return path.

## POWER RESERVE

Under ideal conditions with 400 volts applied to the screen and 500 volts to the plates of a pair of EL34's, the power output is 70 watts.

The good insulation of the EL34's allows the plate voltage to be pushed up to 800, in which case it is possible to obtain 100 watts from the pair.

In our case only 35 watts is required in the secondary of the modulation transformer, and even allowing for losses in that transformer, the power output with the 600 volts we can conveniently obtain leaves plenty in reserve.

The high tension supplies for the plate and screen of the 6146 and the plates of the EL34 are common, so

improvement in regulation over cathode bias is well worth having, because the currents of both the VFO and the class C amplifier flow through the back-bias resistance.

By placing the choke in the negative lead of the supply the voltage drop across it can be used for bias and the need for a separate resistance avoided.

A filter consisting of a .01 meg resistor and a 30 mfd capacitor serves the dual purpose of preventing hum voltages developed across the filter choke reaching the grids of the EL34's and increasing the time constant of bias system so that the voltage does not increase on the peaks of modulation.

The fact that the audio valves are not driven into grid current greatly simplifies the problem and, in fact, makes this simple system possible.

For the same reason, the resistance in the grid circuit can be quite high. One design for a 100-watt class-B amplifier using EL34's, published by Philips Electronic Tube Division, specifies .68 meg for the grid return resistors and therefore we take it the .47 meg we have used is unlikely to cause any trouble with ionisation currents and hence cumulative increases in plate current.

## HALF WATT RESISTORS

The power dissipated in the grid return resistors and also the stopper resistors in the grid and screen circuits is negligible and ½ watt resistors may be used. It is good

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practice to connect the supp
right at the valve socket w
lead between resistor and
connection as short as possib

Don't be tempted to omit t
pressors. Although the mo
is perfectly docile when all
a valve with a Gm of 11 mA
a power potential as high
EL34 can be vicious, if excit
parasitic oscillation.

The modulation transform
in our laboratory model
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but under the conditions
using it the 35 watts of p
is called upon to handle is
reasonable.

## MODULATION TRANSFORM

Unlike the power transfor
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windings but rather magneti
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sulation must be able to w
the peak voltages but the
are adequate here, particu
the highest impedance inv
the 10,000 ohm secondary.

Factors causing saturation
core are the direct current
secondary and the alternati
rent in the primary at low f
cies. The lower the freque
greater the magnetic flux in
in order to handle a given
of power. If you go on in
the power at low frequen
core will saturate and the
wave will become more a
distorted.

Considering the design
opposite direction, the powe
ling capabilities of a give
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this is desirable, in any cas
crease the effectiveness of th
under difficult conditions.

Probably the simplest wa
ducing the bass response i
small value coupling capaci
where a crystal microphone
the load resistor can be red

You will note from the
Figure 2, that the coupling
following the microphone
is only .001 uF and the load
for the microphone 1 me
valves can be varied, of c
you have a clear reason fo
ing.

## EL34 BIAS

Under conditions of co
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design the average bias
EL34's is greater than the
resulting in an increase
tion. For amateur work,
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passes unnoticed, this is
serious but we feel that
sake of the few small wir
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of negative feedback is wo

The optimum amount of
would appear to be about
we have adjusted the cor
our circuit to provide this
Less feedback would no
worthwhile reduction in
while greater feedback m
oscillation due to phase rota
coupling components and t
transformer at very low
high frequencies respectiv

Also the gain reduction
the feedback has to be
elsewhere in the amplifier

e most suitable point for the
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rid of the phase changer valve
difference in voltage level be-
n this grid and the output of
nodulator is so great that a
e series feedback resistor
t have been prohibitively large.
e way out of the problem is to
de a voltage divider giving a
antial inital stepdown so that
eries resistor can be brought
to a readily available value
network specified gives a step-
of about 10 to 1.

s desirable that at least the two
eg resistors be 1 watt types.
resistors are specified rather
a single high value unit be-
of the voltages involved.
vever, ½ watt resistors would
lly be chosen for the 10 meg
d and .47 meg isolating units.
the .01 uF capacitor may have
a low voltage rating.

en you first wire up the
ator the feedback may be posi-
or negative depending on the
ctions to the modulation trans-
r. If the system oscillates
first switched on it is simply
er of reversing the connections
EL34 plates, or to the second-
obtain the correct phase re-
ships.

the phase changer, we have
an extremely simple arrange-
employing two high mu triodes

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gford-Smith. "Radiotron Design-
Handbook" 4th. Ed Chapter 5.

cathode coupled circuit. Un-
plate load resistors are used
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characteristics of the EL34
valves are likely to vary by
a greater amount and it is
ul if a more elaborate ar-
ent is justified. If you are
on this point exact balance
obtained by using equal .22
plate load resistors for the
sections and returning the
f the second triode section to
ificial centre tap made up of,
pair of 1 meg resistors, be-
the plates of the 12AX7.

vever, the arrangement in-
quite a number of compon-
y the time the grid is return-
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ve point.

phase "splitter" circuit using
plate and cathode loads was
ered for this design but using
nient valves will not supply
quired voltages with sufficient
e. Loss of gain would also be
blem.

uitry around the 6BK8 follows
itional microphone preampli-
ractice. High tension for the
plate and screen is fed through an isolating filter consisting of a .068 meg resistor and an 8 mfd capacitor. This serves the dual purpose of filtering out any residual hum voltage and preventing low frequency oscillation due to coupling through the power supply.

The negative terminal of the 8 mfd capacitor should be insulated from earth at its mounting position and returned to a common point, preferably near the valve socket, along with the 1.0 meg grid return resistor, the 2200 ohm cathode bias resistor and the 25 uF bypass capacitor.

If separate earth points are used, there is always the possibility that hum voltages developed across the chassis will be injected into the grid or grids of the valve and amplified. This means that the microphone socket must be insulated from the chassis but this is usually no hardship, since the insulating pieces are usually supplied.

With the .22 meg plate load resistor, the 6BK8 gives a gain of about 200 times making the overall gain such that full output can be obtained with 20 mV input. Many crystal microphones will deliver up to 100 mV under close talking conditions so that in most cases the gain control will not need to be turned full on for 100 pc modulation.

On the other hand, if you wish to use a ribbon or moving coil dynamic microphone which may have a lower output than the crystal the modulator will, in most cases, provide sufficient gain without modification

With crystal microphones the bass response can be attenuated by reducing the load resistor. For full bass response, 5 meg is usually specified but 1 meg is usually a better choice for communication work.

Other types of microphones may be fitted with coupling transformers or a transformer for mounting on the chassis may be supplied. If the latter, it should be heavily shielded with high permeability material to prevent hum being coupled into the grid due to magnetic coupling with the power transformers.

If the manufacturers of the microphone recommend that the secondary of the transformer work into a particular load, this value could be substituted for the 1 meg shown. On the other hand, if you are short of gain, the load resistor could be omitted altogether. The output voltage will increase and the response characteristic show more deviation from the reference level at the extremes of the range. With most reasonable quality microphone and transformer combinations the difference would be negligible for amateur work.

## SIMPLE PRECAUTION

The purpose of the .047 meg resistor in the grid circuit of the 6BK8 is to prevent RF feedback which is often troublesome when a high-powered high frequency unit is installed close to a low level audio amplifier. There are more elaborate standard precautions but normally nothing other than the resistor is necessary.

As with the remainder of the modulator there are many places where ½ watt resistors can be used but there is some advantage in using 1 watt resistors where there is an

(Continued on Page 113)


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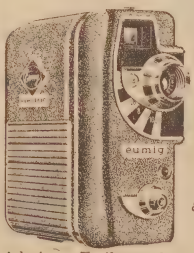


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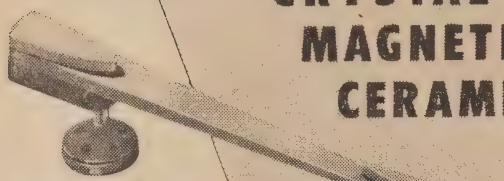

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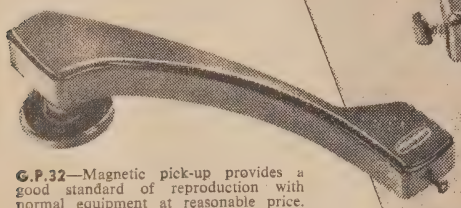
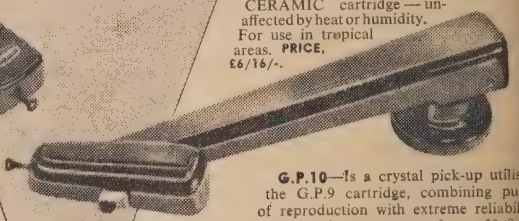
**G.P.50**—Is a HIGH OUTPUT crystal pick-up suitable for reproducing standard and microgroove records through *low-gain amplifiers* as used in small record players and some radios. **PRICE, £4/19/6.**

**G.P.60**—Incorporates the latest type CERAMIC cartridge — unaffected by heat or humidity. For use in tropical areas. **PRICE, £6/16/-.**



**G.P.32**—Magnetic pick-up provides a good standard of reproduction with normal equipment at reasonable price. Output voltage—½ volt at 1,000 c.p.s. **PRICE, £2/12/6.**



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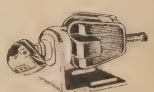

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# ROM THE SERVICEMAN WHO TELLS

**iple intermittents, a tricky portable, and a mysterious rectifier feature in this month's ies. In the case of the rectifier I'm still wondering whether it was freak intermittent or whether the real intermittent is still lurking in the set. Only time will tell.**

y case I'm convinced the e's getting tougher. At one sed to shudder at the thought t with an intermittent in it e intermittent, mind you) in he same way as I used to when someone mentioned on.

that I've become used to the television it seems I'm to be ned to sets with more than ermittent. Apparently the s who create these faults con- at one is no longer sufficient me guessing (I wish I shared nfidence!) and feel impelled them out in twos and threes.

is, of course, is simply lead- o a story about several inter- in one set. Fortunately they sier than some I have known, mere idea of more than one ame set is enough to get me

ver, to the story. It was a ive "baby" mantel set and the a woman, was rather vague he nature of the fault. At ouldn't get beyond the fact . . it sometimes fades". careful questioning suggested was really a failure to come n the set was first switched s it ultimately transpired, as probably good reason for customer's confusion.

ay, I put the set on the bench tched it on. After a reason- riod it showed signs of life sed to bring in any stations, g for all the world as though llator had failed.

## GOOD

as I was contemplating plug- a new converter valve there distinct "plop" and the set ood. All the local stations udible, though the perform- s not as good as it might be. detailed examination of the seemed to be called for.

ped it out of the cabinet and d the HT voltage. All ideas faulty converter valve im- ly vanished when I found volts of HT instead of some- ound 200. After all, that was a bit much of any converter.

ently the oscillator circuit ents were of such values that was barely oscillating with volts or so of HT. In these tances a variation in line could be enough to mean the ce between it oscillating and llating. This would account fact that it sometimes started trouble and at other times d dead for long periods after witched on.

w rectifier restored the miss- s and improved the general ance, as well as making for oscillation. So far, so good, night easily have let it go at that and imagined the job complete. Fortunately I happened to exert a slight pressure on the speaker, which immediately caused most of the signal to disappear with a crackle.

Strangely enough, the trouble turned out to be in the aerial lead. This started on one corner of the chassis near the aerial coil and wandered around to the diagonally opposite corner, where the aerial terminal was mounted on the power transformer. It was a roundabout route, but the point that caught my eye was where it passed behind the speaker.

At least it was supposed to go behind the speaker. In fact it had been accidentally jammed between the back of the speaker and the edge of the chassis cut-out. When the set was mounted in the cabinet the pressure on the speaker was sufficient to close this gap—or it would have done had the wire not been there.

## INSULATION FAILED

As it was, the rubber insulation had been pretty sorely tried. It had held out for a while, but age and heat had taken their toll so that it was now possible to short the aerial lead to frame quite easily. In fact, it was fairly obvious that this must have been happening intermittently.

Together with the faulty rectifier it must have made listening a chancy business, comparable with the early "cats' whisker" days, when it was purely a matter of luck whether one heard a particular program or not.

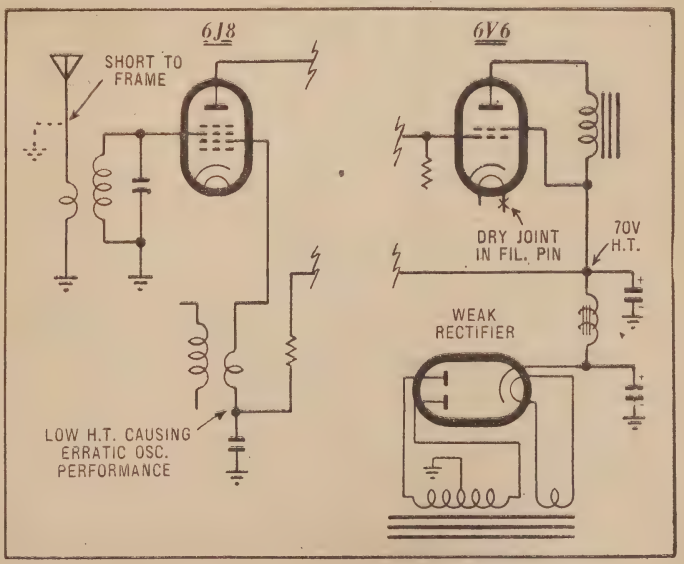
I replaced the lead, using plastic insulation this time and making sure the jamming could not occur again. After a general checkover, which revealed no other faults, I returned it to the customer. I felt that two intermittents in one set—even relatively simple ones—was more than average. With nothing else obviously wrong I never even considered the possibility of the set "bouncing".

## BACK AGAIN

Yet bounce it did. A couple of days later the owner was back in the shop with the set. This time she was emphatic that the set faded out —slowly—while she was listening to her favorite soap opera. It seemed she was something of a resourceful type, for she had looked in the back of the cabinet, noticed that "that" valve wasn't alight, pushed it, and the set came slowly back to life.

"That" valve was a 6V6 and the symptoms could hardly have been plainer. Obviously the filament or filament circuit was intermittently defective, the only question being where.

The socket checked OK and there was nothing obvious in the wiring. That only left the valve itself, and




**Three intermittents in the one set! The reduced HT may not appear to be a true intermittent, yet it had this effect by reason of the erratic oscillator performance. The aerial short to frame was discovered the first time, but the faulty valve needed a second try.**

NAMES TO REMEMBER

# "NOVATAPE"

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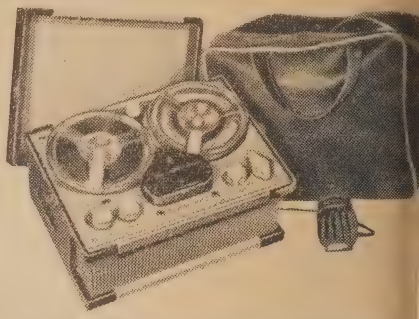

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ached for the soldering iron. Sure
igh, removing the solder from
of the filament pins revealed a
wire with nary a suggestion of
er on it.
arefully cleaning the wire with
point of a knife, I applied some
and a hot iron. When I was
ified that the solder had flowed
o the clean wire I completed the
with additional solder, confiden
it was no longer "dry".
ack in the set the valve behaved
ectly and no amount of pushing
nd would produce the fault
r a reasonable trial period on
bench I returned it to the owner
more. By all accounts it has
n no further trouble.
there it is. Three intermittents
ne set! Where will it all end?

## EXCUSE

eriously, though, two of those
ts should never have happened.
le no one can prevent a rectifier
dly fading away after a reason-
time, it was just plain careless-
on someone's part that allowed
aerial lead to be jammed as it
. Equally careless was the opera-
who produced the dry joint in
valve pin. Thank goodness
iature valves have wiped out
hazard as far as new sets are
erned.
he only other comment I have
aake is that the owner, once she
w I would listen to what she
to say, was able to make intel-
nt and useful observations of
set's behavior. In saving me a
of laborious searching, she saved
elf a worthwhile amount on the
ice fee.
y contrast, the next set came to
without any explanation or de-
s. All I knew was that the family
gone off for a holiday and that
would like the set "fixed" by
time they returned in a couple
weeks.
oping the fault would be some-
ig plainly obvious, I plugged it
or a trial run, only to find that
all outward appearances, at any
, it seemed to behave quite nor-
ly. It was perhaps a trifle weak,
hardly enough to worry the
rage owner. I suspected that
e more serious trouble had
mpted the owner to send it to me.
there was nothing to indicate
it might be.
only wish customers could be
vinced that servicemen are not
chic. This was apparently an
rmittent of some kind — hard
ugh at the best of times—and
le still harder by the fact that
as expected to guess what form
would take.
ask you?

## IT RUN

decided to let the set run while
ackled another one, in the hope
t the fault might show itself. If
idn't, the owner was going to be
ppointed on his return from
days, but there was little I could
about it.
eaving it playing on one corner
the bench, I tackled another set.
ch turned out to be quite in-
sting in itself. This was an old-
e, "pre-octal" five-valve model.
ch seemed lively enough, but re-
ed to play any stations.
laving checked the HT, I headed
the converter, a 6A7, and plug-
it in the valve tester. It tested
OK, so I returned it to the set and up-ended the chassis to attack it from the underside. It was the first time I had taken any real notice of the underside and the sight didn't exactly encourage me.

The 6A7 socket was tucked away in one corner and mounted slap above it was one of those old-fashioned three-section block condensers. It only just cleared the socket, leaving absolutely no room to get at anything. To make matters worse the IF transformers used "flying leads" and no terminals, so that I couldn't even check whether there was any HT on the plate.

Hoping that I wouldn't have to half wreck the set to check the oscillator circuit, I commenced by measuring those components I could reach. Fortunately the cathode bias resistor, among others, was accessible because this proved to be the trouble being completely open circuit.

More important still, I was able to replace it without having to pull things apart, though it did take a little wangling. Once in place, the set came good and I was duly thankful, because it might have been worse.

## UNUSUAL IF

In the normal way I would have finished the job off with the usual routine alignment, but this one wasn't so easy. The IF channel was an unusual arrangement, employing three IF transformers in what appeared to be some kind of band pass arrangement. The set was old and not a well-known make. Tampering with such a system without any data to help could lead to all kinds of bother. Since it appeared to be working correctly and not in need of adjustment I decided it would be safer to leave well alone.

It was not long after I finished this set that the other set suddenly dropped in volume to a whisper and a check showed that the HT had dropped to a mere 60 volts.

Now what, I asked myself, would cause such a sudden drop in HT? The output valve suddenly drawing grid current due perhaps to a leaky coupling capacitor? Shorting the grid to chassis made no difference, thus disposing of that theory. A faulty electrolytic? Lifting one end of each in turn revealed no shorts and by-passing each in turn didn't help, either.

Nothing seemed to be overheating anywhere, as it most likely would in the event of a short, and disconnecting sections of the HT line made no difference, tending to confirm this.

Finally, while waiting for fresh inspiration, I plugged in another rectifier and was surprised to find that the HT returned to normal. Certainly it was nothing unusual for the HT to be down due to a faulty rectifier, but I couldn't reconcile the faulty rectifier with the sudden failure I had observed.

Further, if this was the trouble the owner had observed, was I encountering my first intermittent rectifier? Remembering the 6V6 and the dry joint in the base pin I attacked these pins in a like manner. But my luck was out—all appeared to be sound joints.

Thinking about it only made me realise that there were probably a number of structural faults which could occur in a valve and which would break the filament circuit either partially or completely. Apparently it was only partially in this case, for the thing still worked after a fashion.

Rather reluctantly I was forced to leave the problem unsolved. After all, there is a limit to the time one can spend analysing obscure faults, particularly when there is little hope of a solution. To make matters worse I was even denied the satisfaction of quizzing the owner and establishing whether this was the fault that bothered him.

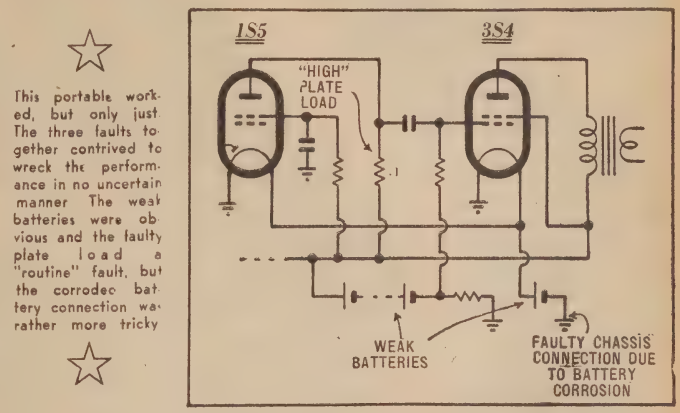
He sent a friend to pick up the set.

## PORTABLE TROUBLES

And finally here is an interesting story about a portable. The customer who brought it to me explained that he had borrowed it from an in-law to take away on his holidays. He was going down the coast a fair way and wanted it in first-class condition in order that he might stand a chance of hearing at least some of the Sydney stations.

He added that the set at present was in poor shape. He was sure it needed new batteries at least, and possibly something else, like a couple of new valves, since the last time he heard it ". . . it was pretty crook, even with new batteries".

It was a personal portable four-valve chassis, bakelite case, and by a leading manufacturer. My first reaction as he handed it across the counter was the condition of the case. It was scored and scratched worse than any I had ever seen and I couldn't help commenting that it




This portable worked, but only just. The three faults together contrived to wreck the performance in no uncertain manner. The weak batteries were obvious and the faulty plate load a "routine" fault, but the corroded battery connection was rather more tricky.

# NEW!

## UNIVERSAL MEASURING BRIDGE

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- Magic eye indicator cannot be damaged by overload or wrong connections.
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**Resistance Range:**
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10 $\mu\mu$F to 10 $\mu$F.

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**Comparative Measurements:**
Ratio 0.1 to 10.0 with switch on "EX"
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"%" (-20% to +25%).

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Case: Twilight-blue dimenso.
Front Panel: Silver-grey dimer
Dimensions: 9" x 6⅜" x 4½."

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to have seen some pretty
ervice.
istomer gave a snort of dis-
fe doesn't know how to look
Leaves it lying in the back
uck without anything around
bounces and slides all over
e. No wonder it won't go
."
ed at the scratches on the
in and visualised it scudding
he rough floor of the truck
tter swayed around a corner.
eem a bit over the odds to
tely maltreat a set in this
when there was no need for
uld only conclude that the
ust didn't care.

## O.K.

e other hand, I can say right
thout spoiling the story, that
valves were intact, a fact
ays something for our valve
turers and should help to
e idea that miniature valves,
ticularly battery types, are
lly fragile.
ver, to return to the set itself,
ner was right about the bat-
They were just about at the
their tether and I had no
n in fitting new ones, even
the set still worked after a
But when I slipped the
s out of the case I had an-
example of the owner's
t-care-less" attitude.
you've guessed it. At some
exhausted set of batteries
n left to rot inside the case,
their gooey and corrosive
over a goodly portion of the
Admittedly some effort had
ade to clean it up, but there
ll plenty of evidence in the
essible corners.
aned out as much of what
t as I could without pulling
e to pieces, fitted a new set of
s, and switched on. Results
tter, but still a long way from
There was, as the customer
uggested, something more
han just the batteries.

## O COME OUT

cked the valves and, as I've
stated, they all tested OK.
ed as though the set would
come out of the case, any-
nce out, I was able to clean
t of the remaining corrosion
n turned my attention to the
al side.
ttle prodding around the 1S5
cuit suggested the trouble was
audio section, since the gain
to be down and those sig-
ich came through were bad-
rted. Making a voltage check
socket I first measured across
ment pins, and was surprised
over that this ware barely
s.
dering that I had just fitted
battery, this should have been
e 1.4—and .2 of a volt can be
t important where the total
is so low and the current
ut to an absolute minimum
nterests of economy.
uring across the battery ter-
showed that it was delivering
d 1.4 volts on load, so the
n was: Where was the miss-
.2volt?
ng the meter prod connected
battery negative terminal, I
he positive lead from the bat-
the first socket pin. This
d the spring contact at the

# SERVICEMAN "BUYS AN ARGUMENT"

Once upon a time we used to buy our meat from a butcher, take our car to a garage when it needed greasing, and trot along to the greengrocer when we needed stocks of fruit and vegetables.

But not any more! Apparently spurred on by the Hollywood passion for superlatives the butcher is now a "purveyor of meat", the garage is a "lubritorium", and—horrors of horrors—the greengrocer prefers to be known as a "fruitologist".

Although this fashion has obviously penetrated many other callings — even the lowly "rat catcher" is now a "rodent control officer" — I never dreamed it would strike as close to home as it has.

I imagined, poor blind fool that I was, that I was well within the bounds of propriety when, as sometimes happens, I have occasion to ask the charming young lady at "—00" to send a mechanic to fix my telephone.

Instead it seems I have made the gravest of social blunders, blotted my copy book "real proper"; offended in a manner which can never be forgiven. I feel like an admiral who has tripped over his sword and fallen flat on his face just as he is about to be knighted. Never again will I be able to look the world in the face without a sneaking fear that someone will discover my terrible secret.

What have I done? The following extract from a letter tells the whole sordid story:—

*"I wish to bring your attention to a very bad mistake in your recent issue. It occurred in the "Serviceman Who Tells" and referred to "telephone mechanics". Surely such a progressive magazine as yours should realise that we are no longer "mechanics" but "technicians", and "telecommunications technicians" at that!*

*"Your article was very nearly the cause of a riot at one exchange and it was suggested that our former friend "The Serviceman" be used as a bleeder resistor on a large TV set. However, as his articles are always interesting, we decided to give him a chance to redeem himself and explain his error in a future article.*

*Yours faithfully,*
*B. J. D. (Bexley, NSW).*

See what I mean? In future I must ask that charming young lady to send the "telecommunications technician" to fix my "telecommunications device". I only hope she knows what I mean.

While I bow my head in shame, prostrate myself before my accusers, and beg humbly for forgiveness, another point occurs to me. What should I call myself? Obviously the word "serviceman" is now obsolete. Would "Electronics diagnostician" do, or can the bright boy who thought up "telecommunications technician" think of a better one?

Never mind chaps, as Snakespeare said, "A rose by any other name . . ."

battery positive terminal and the switch on the back of the pot—both potential sources of trouble—but there was still 1.4 volts at the socket pin.

However, as soon as I moved the negative prod from the battery to the socket pin, the voltage dropped to 1.2 again. Clearly the trouble was in the negative line but, since this was the chassis, I'll admit I was puzzled for a few moments.

Nevertheless, I commenced tracing the negative line with the meter prod, just as I had done with the positive side. It didn't take me long and the fault was painfully obvious when I found it.

The negative end of the battery (two torch cells in parallel) was held against a spring contact riveted in the centre to an aluminium bracket. The bracket was riveted to the main chassis (of plated steel) and it was at this point that the trouble was found. The corrosion from the exhausted batteries had attacked the aluminium, developing a resistance across which the missing .2 volt could be easily read.

There seemed to be little point in trying to remove the corrosion. Most of it was tucked away between the two metal surfaces and would have meant dismantling the bracket from the chassis. Instead, I took the easy way out and ran a length of hookup wire from the battery contact to the negative pin on the socket.

Not only was this easier, but I imagine it was a lot more reliable. In fact, I venture to suggest that this is a modification the manufacturers might well consider. Admittedly batteries shouldn't be left in sets, but we must face the fact that they often are. This being so, a riveted connection in this position is just asking for trouble.

## STILL POOR

Performance was now somewhat better, but still not right. I continued my checking of the 1S5 voltages. Screen appeared to be normal but at the plate there was only the slightest flicker of the needle. Setting the meter to the "1000 volts" range I bridged the plate resistor with the two prods. The result was dramatically effective. The weak, distorted signal suddenly changed to a (relatively) strong, clear one.

The trick I had pulled was quite a simple one. The plate load—a 1 meg. resistor—was virtually open circuit and I had temporarily replaced it with the meter which also has a resistance of 1 meg on the 1000 volt range. Even if the value is not optimum, it is often a quick and easy way of confirming a suspected open circuit resistor.

By way of a change in personal portables, this resistor wasn't particularly hard to replace and I soon had the set running properly again. When replaced in the cabinet it didn't sound real bad.

Well—not for a personal portable, anyway!

In any case I know nothing about Radio
However I now have a son aged 9 t
remembering the pleasure I received as
dad from messing around with simp
radio, I would like to interest him in
Hobby. Unfortunately we live in a valley

# HERE'S WHAT YOU WANT, DA

pick out the parts from the old sets, but the
assembly would need to be clearly (for fools)
out in the diagram. I am not greatly
concerned with performance — my main
interest is to get the boy keen on the Hob
Later as he grows older he can then learn

The excerpt reproduced above from one of several letters we've received lately from fath
who, very wisely, want to encourage their sons in a constructive hobby. However, they've b
hampered by lack of knowledge and perhaps lack of funds — hence their appeal to us
assistance.

TO launch into a description of yet another new small set is clearly not the answer they want. The cost of the parts, added to a new suit, a bag full of school textbooks — and the bag to put them in — is apparently more than the family budget can supply to one junior member.

So the radio doesn't get built!

But down in one corner of the garage is an old mantel set or an old console, which hasn't made a sound for many a year. Dad, or perhaps the young hopeful, reasons that it must contain some parts which can be put to use.

## WHAT NEXT?

The set is duly placed on the bench and dusted off, but then the question arises: What to do next?

This is the stage when Dad takes the pen and puts his worries to paper And you can bet that the letter ultimately reaches the correspondence basket of Radio, TV and Hobbies.

In fact, as we said earlier, that is precisely what has happened on several occasions during the past few weeks If several fathers have seen fit to write to us, how many more fathers — and sons — must have similar ideas?

So — put on your dustcoat, Dad, and let's see what can be done. And at the same time, it might be wise to blow a little dust off your radio knowledge from earlier years. It will help a lot in recognising useful components.

Perhaps it would be wise to point out, first of all, that a receiver which has long been put out of use, is likely to be faulty. It may be, of course, that it was just put aside when the new set was installed, but a breakdown would like as not have been the signal for its rejection.

In any case, many years of storage in the most "unhealthy" places for a radio will have left their mark on the veteran, and it might be extremely unwise to plug it in to "see if it works."

In particular, electrolytic filter capacitors deteriorate with age,

by

**L. Varady**

especially when not in us
switching the set on may easil
age the rectifier valve, the
speaker or the power transf
But, if you insist on switc
on, be ready to turn it off in
ately if the rectifier flashes o
heats or anything inside the
gins to spark or to smoke.

## NOT VITAL

Whether or no the set oper
really not vitally important,
it is not our purpose here
to explain how to "fix" an
To do so would be to prod
article on servicing, encouragi
to buy lots of new parts t
a set that you didn't need any

What our correspondent ask
is a how-to-build it article w
I-managed-to-build-it-myself
est paramount.

Why argue then?

But what components are li
be found in such a set, whic
prove useful in the constructi
new simple receiver?

Well, first of all there is the
transformer. This item is inv
quite a substantial unit. for
reasons. The old-time valv
quired fairly heavy current
and the transformers were

rated at less than 60 mA, s more than adequate for our es.

ner reason for their generous is the fact that they had to the power required to main- e magnetic field of the elec- mic loudspeaker, which was bly used. To this end, the ondary winding is usually t 385 volts, of which about ts are absorbed in the field s.

## R WINDINGS

es the HT winding there are ndings provided for the rec- lament, usually 5 volts, and nore for the remaining valves. r 6.3 volts, depending on the valves employed.

neral, the power transforme old set will either be good or

ght be dusty, slightly greasy ntly waxy but, if the insula- n't charred and if it doesn't hen it is most likely in good order.

ver, if it does smell of burn- nish, if the insulation around ncings is charred, or if it is ded on the chassis by dark, elling "goo" expelled from ails, then "give it away". The mer has shorted internally or verloaded badly and is not a second look.

here's hoping that it hasn't such a fate.

connections on old transform- usually made to a terminal which, in most cases, is clear- ked with the voltages avail- f dust and grime make it dif- o see the markings, clean the with methylated spirits before any connections to it.

e transformer happens to be h leads instead of a terminal try to identify the connections e way before you remove it ne old set. See which leads he power mains, which go to tes of the rectifier, which to ament of the rectifier, which other heaters, and so on.

how they emerge from the g, or the color code — or tie on the leads for want of a bet- thod.

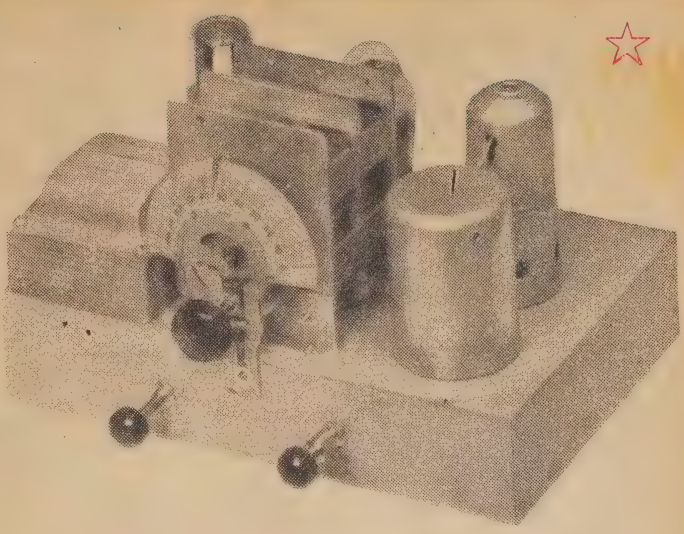
## MIC SPEAKER

second item of importance loudspeaker which, as men- earlier, is most likely to be electrodynamic type. The out- ansformer is usually mounted speaker frame.

ss the transformer or field coi t out or damaged, the speaker be capable of making a noise. gh sundry rattles and scratch- nds may become evident later rust being deposited in the which the voice coil moves.

ing the centre of the cone with the fingers should re- ny such troubles. The cone move freely at least about without giving any noise. If ing sounds are evident, a few of air from a bicycle pump d into the centre of the cone the front, and also from the sometimes work wonders in rid of the dust. So much e speaker.

her, there will be some kind

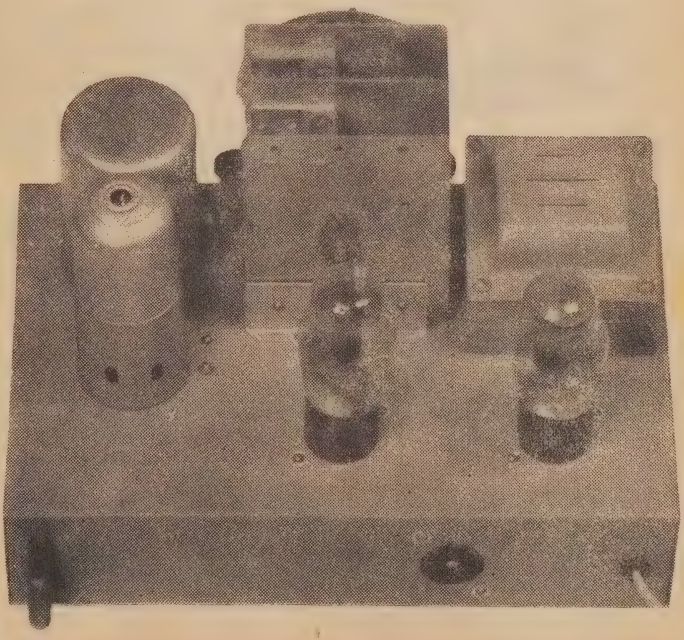


The completed set. Volume contro is on the left, reaction on right, and tuning above them.

of a tuning capacitor on the set, probably a 2-gang or even a 3-gang, and a dial to go with it. These will also be part of the new set.

The gang should be examined for bent plates and corrosion on the insulators supporting the fixed plates. Only one section needs to be in good order, so long as the shaft is moving freely. A brushing over with methylated spirits and some lubrication on the bearings should be sufficient to bring it up to standard.

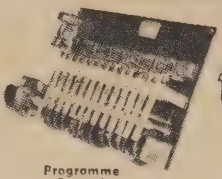
Getting the dial into action is a purely mechanical problem which should yield to a spot of lubrication and adjustment. The dial doesn't need to look pretty but it should op-



The old style components are easily recognised in this picture. From left to right we have the coil can, tuning gang and power transformer, and below them the valves, detector, output and rectifier.

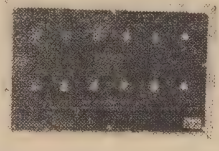
# TIME CONTROL AND AUTOMATION

Process Timers instantaneous resetting, 1/10th sec. to 24 hrs., accuracy from .25%.

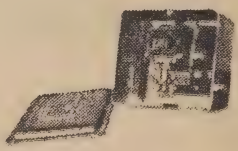


Programme Control.

"PAYNECO



Timer indicating 1/1000th sec. accuracy plus minus 1/1,000,000 sec.



Manufacturers Type Timer.

Auto
reve
cont

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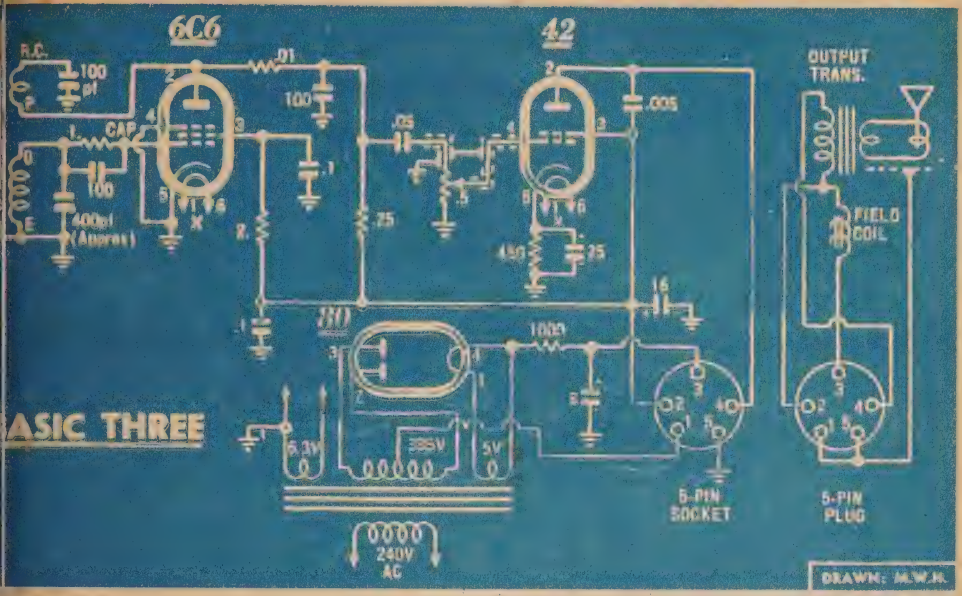
# CIRCUIT ADAPTABLE FOR A VARIETY OF PARTS




ASIC THREE

ircuit is a straightout regenerative detector with power output and mains power supply. The valves shown are the most ion ones, but other suitable types are listed in the parts list. Socket connections may have to be changed for alternative types.

smoothly, without binding or g, if you want to save a lot oyance when tuning.

one of the coils will be re- in the new set, and preferably ial coil should be set aside for rpose. This, of course, can be in the old set by tracing the om the aerial terminal on the he coil to which it is connected ain to be the aerial coil.

coil is going to be the heart new receiver and therefore be in a good condition. Most old receivers used bakelite or ard coil formers of about 1¼in er, wound with silk or enamel- d wire. The windings and their als should be free from corro- There should be no dry joints the wire joins the terminals.

## Y REPAIRED

ittle bit of damage, however, fixed quite easily, as will be ned later on in the text.

condition of the valves will lly be of prime importance. the four or five valves norm- ontained in the set, the ones ted in the parts list as suit- hould be selected. Most radio will gladly oblige by testing and it would be wise to have tested because, obviously, the ll only work if all the valves working order.

the purpose, they needn't be t. As long as the dealer pro- es them "Fair" or "50 pc" or ning to that effect, they should

es need sockets, too, and exist- ockets should do quite well. More than likely these will be of the early wafer type. Any corrosion should be cleaned off the terminals, and the sockets should be given a thorough soaking and brushing in methylated spirits or solvent to get rid of any flux which may have seeped between the wafers.

If the sockets are of the centre rivet type, they can be dismantled and the inside of the wafers cleaned thoroughly. When reassembling, make sure that both wafers are in the correct position, before clenching the rivet again.

Cleanliness is important for the rectifier and loudspeaker sockets because these will be subject to considerable voltages and will be the first ones to break down, if the insulation is impaired by excessive flux. If any charring shows around the socket holes, due to previous breakdowns, the socket should be discarded.

Bend the contacts, if necessary, while you are on the job, to increase their grip on the valve pins.

Some kind of chassis will also be required to build the set on and, although we have constructed ours on a new chassis for the benefit of those readers who have only the component parts, there is no objection to constructing the set on the original chassis.

After stripping the chassis of all the parts, a good coat of paint will

## PARTS LIST

Valves suitable for detector: 6C6, 6D6, 6U7, 6K7, 78, 6S7, 6J7, 77, 6SK7, 6SJ7, 24 A, "G", "GT", or metal valves equally suitable.

Valves suitable for output: 42, 6F6, 6V6, 6K6, 2A5, 59, 41.

Rectifiers: 80, 5Y3, 5Z3, 5U4-G.

1 Transformer (see text).

1 Electrodynamic loudspeaker.

1 Chassis (12 x 8 x 2½in, or larger).

1 Aerial or Reinartz coil (see text).

3 Valve sockets to suit valves used.

1 5 pin socket and plug.

Capacitors:

1 400 pf tuning capacitor.

1 100 pf reaction capacitor.

1 16 mfd 600 VW electrolytic.

1 8 mfd 600 VW electrolytic.

1 25 mfd, 40 V electrolytic.

2 .1 mfd 600 VW paper.

1 .05 mfd 600 VW, paper.

1 .005 mfd 600VW paper.

2 100 pf mica.

Resistors:

1 2. or 2.2 meg, 1 1. meg, 1 .25 or .22 meg, 1 .01 meg, all 1W, 1 .5 meg pot, 1 1000 ohm 5W, 1 450 ohm 3W.

Sundries:

Hookup wire, shielded wire, 1 3-lug, 1 8-lug tagstrips, nuts, bolts, solder lugs, rubber grommets, mains flex and plug. 1 large valve shield, knobs, dial, 2 spring terminals.

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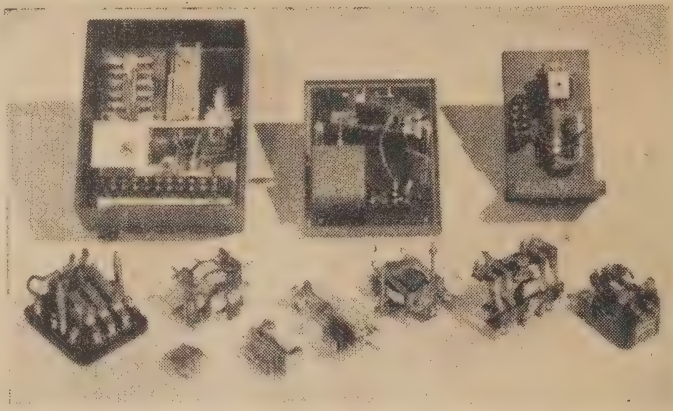

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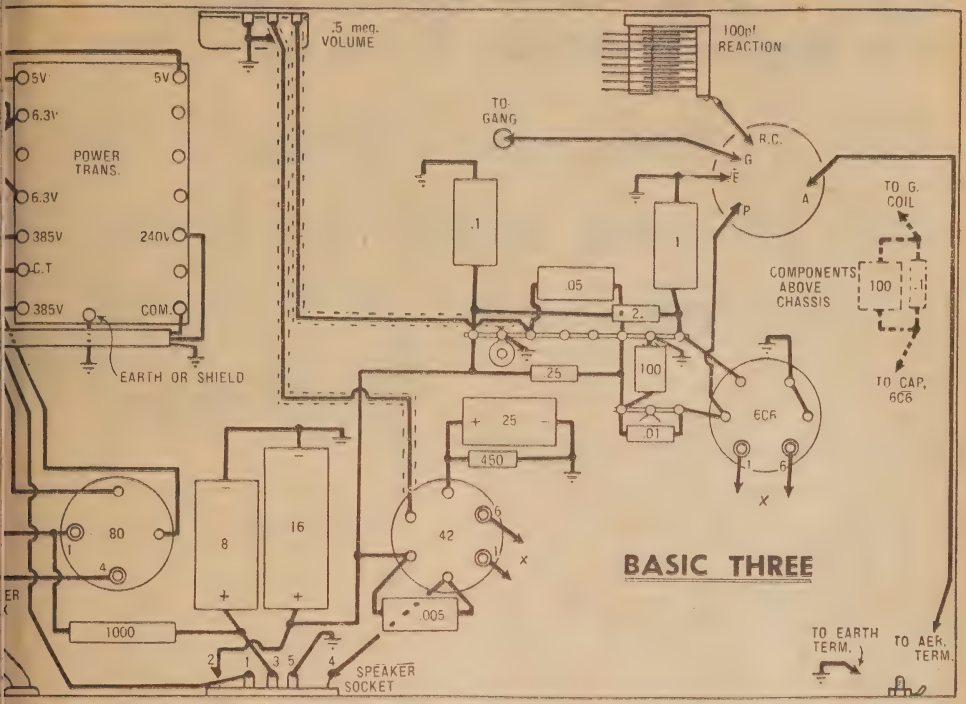
# UNDERNEATH WIRING DIAGRAM FOR "BASIC 3"




ose of our readers who are not so familiar with circuit diagram this wiring diagram should make the job easier. Transformer al panels are not standard, and the connections may be different on different makes.

a neat appearance and pre- from rust. Before painting, rse. the chassis should be thoroughly and existing rust emoved with sandpaper.

of the minor components, is resistors and capacitors, be in fair order. Nevertheless with a multimeter is worth- o see that resistors are near their marked value and ors do not show appreciable .

capacitors will almost cer- be okay but tubular paper an deteriorate with age.

## USE THEM!

e are only two capacitors that not in any circumstances be The first and second filter ytics. These would have dried out or become inopera- ring storage, and their use certainly invite disaster for ctifier, or even the power mer and loudspeaker. A f new capacitors is really ul.

e will also be need for some reaction capacitor. Some of y early receivers do contain m, but the majority of sets o be used for our purpose do small variable capacitor of mately 100 pf capacity will do This capacitor will have to rolled separately so that the section of tuning capacitor be used for the purpose. ng lined up all the necessary components, the assembly can be started. In the first place, the coil should be modified to suit the new circuit.

The normal aerial coil, as found in a broadcast receiver, usually consists of two windings on a 1in or 1¼in former. The smaller of the two windings, about 15 turns, is the aerial winding. The lower end of this is usually connected to earth and the upper to the aerial terminal of the set.

Spaced about 1/8in is the tuned winding of the coil, normally of about 100 or 110 turns. The lower end of this is also earthed, while the top end goes to the grid of the first valve.

The ends of the wires in these old coils is usually brought down to the lower edge of the former to solder lugs to facilitate connection. If there is any sign of corrosion or a suspicion of a dry joint — both fairly common in old sets—the wires should be unsoldered, cleaned with some fine sandpaper and re-soldered properly.

Another two terminals can then be fixed to the former to serve as anchor points for the reaction winding. This can be accommodated at the top of the coil former, about 1/8in above the tuned winding. Two holes are drilled into the former, above the tuned winding and in line with the new terminals. The spacing between the holes should be about 3/8in or as much as the former will allow.

To wind the reaction winding, the end of the wire is passed through the lower hole and attached to one of the vacant solder lugs. The required 35 turns are then wound on, in the same direction as the grid windings. About 36 to 40 g. enamel wire is suitable for the job, and at a pinch the small quantity required could be salvaged from another coil out of the original set.

## SPACING IMPORTANT

If all of the 35 turns cannot be accommodated on the former in the one layer, there is nothing wrong with winding it in two or even three layers, provided that the winding is spaced at least 1/8in from the tuned winding.

And, even if there is no room at all on the former for an extra winding, there is no reason to despair. In such cases the reaction winding can be wound on a small cardboard ring of suitable size and placed either in the top end of the former, or around it.

Here again it is wise to maintain a little clearance between the windings to avoid excessive capacitive coupling between them. This capacitance is effectively in parallel with the tuning capacitor and too much of it will crowd the stations toward one end of the dial.

If you wish to save yourself the trouble of modifying the coil, a commercially-made Reinartz coil can be used with equal success.

Before fitting the coil in its shield-can, it will often be necessary to attach leads to the terminals, so

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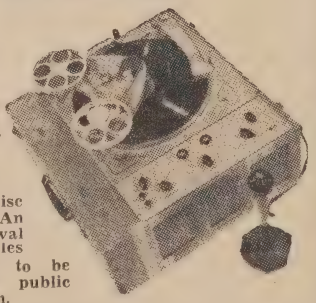

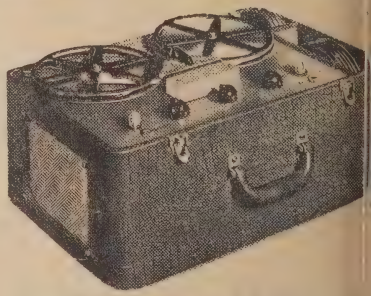

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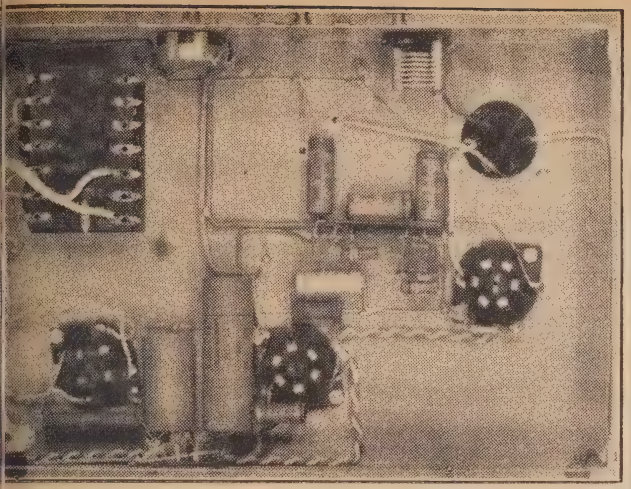

underneath photograph of the set shows the actual arrangement of parts. The
it is not critical and may be altered to suit the chassis so long as the detector
pt away from the power supply, and the leads carrying RF are kept reasonably
short.

he coil can be connected into
rcuit after it is mounted. The
should be coloured differently,
ntified in some other way so
will be no doubt about their
se when connecting them into
rcuit.

leads will be necessary from
grid" terminal, as this has to
t both to the gang and the
p of the valve. One is brought
the top of the can and the
at the bottom.

## D EARTHING

n the coil is ready, the major
ments and valve sockets can
unted on the chassis. On the
side of the chassis the paint
be scraped away under the
ing bolts of different com-
ts so that solder lugs placed
them will make good contact.
ake doubly sure these lugs
then be interconnected with
16 to 18 g. tinned copper wire.
des providing handy earth
ctions throughout the chassis,
vill also avoid trouble should
the lugs fail to make proper
t with the chassis.

hookup wire used in the
al set is likely to have de-
ated with age, and it would
wise to use it in view of the
oltages which may be present
set. For this reason a few
of good plastic covered hook-
ire would be a good invest-

heater wiring can be put into
first. This will start at the
ormer terminals marked 2.5
V, depending on the heater
e of the valves used. From
t goes first to the heater pins
output valve, and then to the
or socket.

n the valves shown in the cir-
r indeed with any other types
6 or 7-pin sockets, the heater
should be connected to the
nick pins.

n the more modern types, such
6F6 and the 6J7 the filament
is connected to pins 2 and 7

of the octal socket. Note that the filament of the rectifier valve is NOT connected to this circuit.

A special 5V winding is provided on the transformer for this purpose. For the 80 the two thick pins should be connected to this winding, while for the 5Y3, another likely valve, pins 2 and 8 of the octal socket are used.

A pair of wires connects the rectifier plates to the 385 V terminals on the transformer. Between these two terminals there is another terminal marked CT. This connects to pin 1 on the loudspeaker socket. When the plug is inserted into the socket, this pin will be earthed via a bridge in the plug. This is included as a safety precaution, so that no HT will be applied to the valves, unless the speaker is plugged in.

A 1000 ohm resistor of at least 5 watts rating is connected between pin 4 of the rectifier socket and pin 3 of the loudspeaker socket. The first filter capacitor also connects to the latter. One side of the speaker field is connected to the corresponding pin of the speaker plug.

## FIELD CONNECTIONS

The other end of the field connects to one side of the output transformer primary and another lead is connected between the junction and pin 2 of the plug.

Pin 2 of the speaker socket becomes the main HT distribution point for the set. The second filter capacitor (16 mfd) connects to this point, and leads are taken from here to the screen (pin 3) of the output valve and to the tagstrip near the centre of the chassis.

The plate (pin 2) of the output valve connects to pin 4 of the speaker socket. A lead runs from this pin to the other end of the output transformer primary. A shielded lead from the grid to the 0.5 meg volume control, the cathode resistor and bypass, and a small capacitor from plate

**(Continued on Page 115)**




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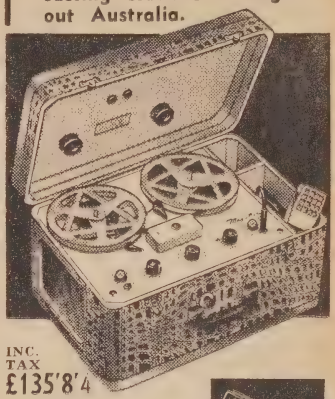

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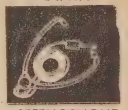

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# A COURSE IN TELEVISIO

## PART NINE...THE COMPLETE TELEVISION RECEIV

**Before launching into a lengthy, stage-by-stage discussion of a television receiver, it ma be helpful to study the makeup of such a set in block schematic form, noting how the i coming RF signals are ultimately transformed into a visible picture and the appropriate soun**

THE processes and the circuitry involved in this transition are far more complex than those encountered in an ordinary AM broadcast receiver and the reader must be prepared for many new techniques and new ideas.

Don't be discouraged if some of these seem beyond you at first encounter, particularly those having to do with the synchronising and deflection circuits. You will be doing well enough, at the outset, to grasp the underlying principles.

Perhaps the most logical step is to refer to figure 58, reproduced herewith, and to trace the course of the vision and sound signals from aerial input to the vision and sound "output" devices — the picture tube and the loudspeaker.

### SEPARATE CARRIERS

As we have already explained, the vision and sound signals appropriate to each individual station are transmitted in defined "Channels", which have been allocated within the frequency range of approximately 50 to 200 Mc.

It will be recalled that the vision and sound carriers pertaining to each station are separated by 5.5 Mc, the vision carrier being the lower one and amplitude modulated. Frequency modulation is used on the sound carrier.

The first requirement is an aerial system capable of intercepting signals over this portion of the spectrum and feeding them down to the receiver input circuits. This involves specially designed "television" aerials, of a type which have been discussed fully in the last two articles.

Further comment here is not required.

It is also obvious that the RF input circuits of a television receiver must be capable of accepting and selecting signals over the same portion of the spectrum. In other words, every television receiver must incorporate a VHF tuner, designed to operate over the frequency range of approximately 50 to 200 Mc.

As readers will know, who have carried out any experiments on very high frequencies (VHF), this can be quite a problem in itself.

Tuning coils diminish to a few odd turns, tuning capacitors become difficult to use, connecting leads introduce troublesome "stray" inductance and capacitance, bypass capacitors cease to work efficiently, valves "load" the circuits to which they are connected, tuning tends to drift disconcertingly and so on.

It can only be accepted as a tribute to radio engineers that most of these problems have been reduced to insignificant proportions, so that a modern television receiver can be operated and tuned by non-technical members of a household, with little more difficulty than a routine broadcast set.

**All modern television receivers use the superheterodyne principle, because it offers the best solution to the problems of obtaining wide frequency coverage, adequate gain, and an overall selectivity curve of fairly critical shape.**

Most receivers, too, employ an RF amplifier stage ahead of the frequency changer.

The RF stage confers some benefit in terms of gain and signal-to-noise ratio, isolates the local oscillator from variations in the aerial circuit, and also prevents energy from the local oscillator from being coupled into the aerial and radiated thereby.

This last point is a very important one because random signals radiated into space from a multiplicity of local oscillators can cause severe mutual interference between television receivers in any given district.

Gang tuning capacitors find little or no place in the tuning circuits

*by Neville Williams*

of modern television receivers. They cannot provide an adequate tuning range and, in any case, lead to circuits having far too high a ratio of C to L.

For purposes of tuning, some television receivers have used rotating coils, with sliders to pick off as many turns as might be required to select any given signal freqency. The inductance value so selected resonates with little more than the minimum incidental circuit capacitance, thus ensuring the most favorable L/C ratio at all frequencies.

Other tuners have used switched selectors which connect selected increments of inductance into circuit, with a small variable capacitor for fine tuning only.

The most popular method, however, is to use a "turret" tuner, in which tiny inductors and capacitors are brought into circuit as required, a separate pair for each television "channel".

The inductors are adjusted d the alignment procedure so tha aerial, RF coupling and osci circuits are all in correct reson fine tuning being accomplished vernier capacitor on the oscill

These remarks are intended mere outline. Tuning circuits be discussed at length in a coming article.

Contrary to popular practi the medium-wave broadcast RF amplifier valves are seldom todes.

Triodes are preferred for superior performance in the region, particularly at frequ above 100Mc.

"Grounded grid", "cat coupled" and "cascode" RF a fiers are commonplace in tele parlance, whereas once they terms peculiar to a select gro "Hams" and others concerned VHF and UHF communication

Frequency changing stages take on forms which will be strange to those new to VHF Multi-grid "mixers" give pla twin-triode and triode-pentod quency changers, with oscillato cuits which often revert to textbook forms.

Such unusual oscillator configurations are adopted, som because they promise better quency stability, sometimes b the designer has no longer to about keeping his oscillator capacitor at earth potential, a medium-wave broadcast recei

The design of the RF, mixe oscillator circuits are highly dependent electrically and, b of the need for short leads, & variably grouped closely to Physically, they are usuall sembled into a single, com tuning unit.

The tuning section has the been drawn as a composite bl figure 58, and this is the wa will normally find it in a co receiver.

### TURRET TUNERS

A turret tuner is illustrated where in this issue and will scribed in detail in a later

From the frequency change incoming signals emerge, as be expected, at "intermediate quency. They pass into the marked "Vision IF" in figure

Actually, there are two sets of intermediate frequenci presenting the beat resultants local oscillator with the vision and the sound signal pertain each television station.

**Just as the high modulatin quencies make it essential to t television signals in the VHF**

**essary to design for high te frequencies in the re-**

ld not imagine, for ex- ulating frequencies up to superimposed on a con- 55Kc channel!

n authorities in each coun- ly specify the intermediate which shall be regarded ard" for local receivers cedure allows the station allotments to be made in ch will give some protec- t image interference and unnecessary interference ces from IF energy ac- diated by domestic TV

## AN PRACTICE

Australian practice is to local oscillator at a fre- her than the desired e immediate effect of this relative position of the vision signals is reversed hannel. (This point will later.)

hey are still separated by al frequency difference of picture IF is the higher cy.

of 30.5Mc has been as standard for the sound e frequency and 36 Mc on IF. The overall align- erefore adjusted to pro- resultants from all chan- s a normal medium-wave set produces an IF of n all broadcast stations happens to be tuned. amplifier channel in a eceiver poses yet another gn problem. Considerable be achieved, as a first t, if the very small sig- ced from the frequency e to be amplified enough dulated (or detected) and an audio amplifier e tube circuit.

me time, the IF channel nibit a wide flat-topped curve if it is to amplify components to about reject all signals fairly ich do not belong to the elevision channel.

terms, the IF channel has and amplify the sound resultants (30.5 and all frequencies in between eject frequencies outside imate band.

ve this result, which long-standing problems ped" AM tuners, de- to resort to such methods oled windings in the IF s, band-pass circuit or stagger-tuning. We more to say about this r.

## S" CIRCUITS

cient to say that the need ially-shaped, flat-topped curve has led to the otion of the term "band- s" in place of the usual uits" in much technical re

y, however, the signal (or amplified and passed on o or vision detector, as n figure 58

oint, the signal in which ediately interested is the from the vision carrier. 36Mc intermediate fre-

quency and carries an amplitude modulation component equivalent to the original video signal from the TV camera chain.

This is extracted by the video detector and made available as a video signal voltage.

In some simple receivers, the video signal voltage delivered by the detector is high enough to apply directly to the intensity grid circuit of the picture tube. In more complex receivers, it is passed through some

> This instalment can profitably be read in conjunction with the article on page 46 which describes, in detail, the design of a typical complete television receiver. The circuit diagram for this receiver is subdivided into similar block sections as our figure 58

form of gain control and amplified before application to the tube.

Either way, however, the video signal appears in the intensity grid circuit of the picture tube and varies the intensity of the electron beam in sympathy with the video signal originated right back at the television camera.

In a broad sense, this part of the circuit might therefore be considered as complete.

However, as we observed in one of the earlier articles, it is of little use having a spot on the screen of a picture tube, which merely varies in brightness according to the instantaneous value of a video voltage.

**Before it can be resolved into a picture, the electron beam must be simultaneously deflected back and forth and vertically, to duplicate the movement of the scanning beam in the television camera.**

As a first step, this requires the provision in the receiver of two oscillator circuits operating at near the required line and frame frequencies. These oscillators must then be fed with the line and frame synchronising pulses, radiated by the station, so that they will lock firmly into synchronism with those controlling the camera.

All this involves another major section in a television receiver.

Special "Sync. Separation" circuits must be provided to separate the line and frame pulses from the video component as it emerges from the video detector and/or amplifier.

The pulses must then be amplified and shaped, so that they will have a precise and instantaneous effect on the line and frame oscillators. Any ambiguity about the pulse would only blur or break up the picture.

Many receivers go further and provide limiting and so-called "flywheel" circuits, which ensure that the line and frame oscillators will not be triggered by random pulses from auto ignition systems or other forms of electrical interference. This further complicates an already complex collection of circuitry.

Whatever the system adopted, however, the final requirement is for the line and frame oscillators to produce a sawtooth output waveform, capable of deflecting the electron beam horizontally and vertically, and locked precisely with the corresponding deflection circuits at the camera.

As explained in an earlier article, modern picture tubes almost invariably employ magnetic deflection, because their wide screens and restricted length call for deflection angles which cannot readily be achieved by electrostatic methods.

## SAWTOOTH CURRENTS

Therefore the deflection oscillator circuits must be manipulated to produce a sawtooth CURRENT waveform through their respective sets of deflection coils.

Having devised circuits which will suitably deflect the beam, and having arranged for the said beam to be modulated at the required video frequencies, a picture should become visible.

However, a complete receiver must somewhere incorporate a means to focus the electron beam, either by means of a magnetic yoke or by varying the voltage on a particular anode.

The beam must also be centred on the screen and the horizontal and vertical scans adjusted in magnitude, so that the resulting picture has the right proportions or aspect ratio. Pre-set controls are required for these functions.

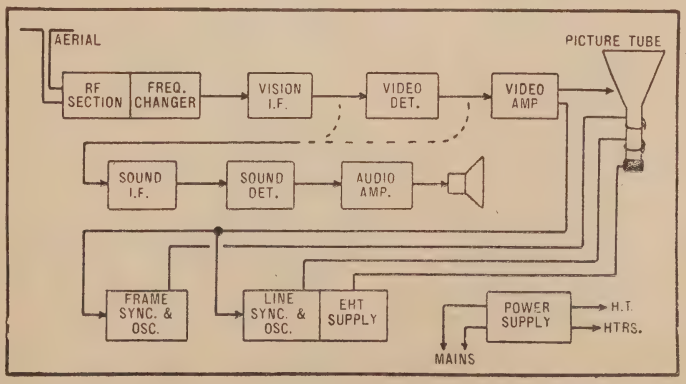


Figure 58. Here, depicted in block schematic form, are the main sections of a modern television receiver. Ensuing articles in this series will discuss each of these main sections in turn.

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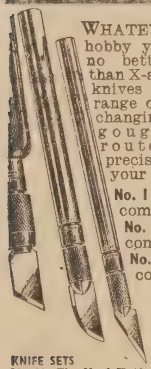

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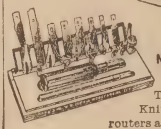

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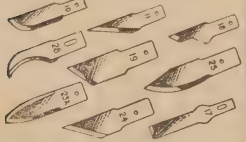

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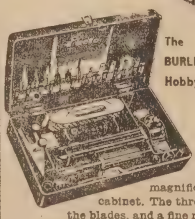

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But what of the voltage to the picture tube the s "EHT" voltage?

In early television receive was provided by a voltage m ing system, operating at 50 c the main power transformer. ions to this were, firstly its c ation and secondly, the fact required a relatively larg capacitor for smoothing purp

Once charged, such a c was a rather dangerous de have in a set from the point of servicemen.

## ALTERNATIVE PRACTICE

Alternative practice was an RF or supersonic oscill produce high voltages, whic subsequently rectified and filtered by a much smaller c than that required at 50 cp systems have largely been sup in the interests of simplicity.

**Almost universal practi the moment is to utilis sudden current pulse gen by the line oscillator as it the beam back across the s to commence each new sc**

A special winding is prov the transformer which is n anyway, to transfer the pulse from the line deflectio fier to the appropriate coil deflection yoke.

The special additional win a large number of turns and flayback pulse, generates a v peak voltage. It might be lik the peak voltage which is d in the secondary of a m ignition coil.

The voltage peak, whic repetition frequency of ju 15,000 cps (the line freque duly rectified and filter applied to the high voltage the picture tube.

Fortunately, the current ments of this latter are e small and the loading invo the deflection amplifier tolerable.

In fact, the EHT voltage is ed almost for nothing!

However, the two circuits deflection and EHT generat electrically interdependent, they are depicted together 58.

The next major questi regard to the Sound inte frequency, which has yet t cussed.

Early practice was to di at the output of the mix early IF amplifier stage an into a separate IF channel at the sound intermediate fr

While this is a logical step respects, it does involve vision of a complete, sepa channel, at a cost of sever and transformers.

Ultimately, the signal wa a discriminator or ratio thence into a convention amplifier.

Most common modern p to use the so-called "inte beat, which occurs betw Vision and Sound signals channel.

These signals beat togeth duce a difference frequen Mc at the output of the tector. Because the Vision a carriers are always sepa 5.5Mc, the resultant is prese stations.

ct, transmission standards are to make it an important re- ent.

ermore, since it results from terodyne of two modulated , the 5.5Mc component car- dulation components belong- both.

## ) IF TRAPPED OUT

actice, the 5.5Mc component ed out of the picture cir- d diverted into a subsidiary , where it feeds into an FM of one type or another. The d function of the FM de- nd, in some cases, a limit- olifier, rejects any AM com- due to the picture modulation urious interference.

resulting audio voltage is e substantially free from ex- signals and is passed an audio amplifier to a udspeaker. As a rule, the stem is not pretentious, the equirement being for pleas- d quality, as heard by people et from the receiver, view- picture.

inal main sub-section of a n receiver is the main power This requires to be fairly ial, because the number of nvolved draw a substantial of heater and high tension

sual to avoid large high ten- ages, both in the interests of and voltage stress on com- Thus, the HT voltage in a iver may not be much more , but the current drain may m to 200 milliamps.

calls for rugged rectifier large filter choke and filter s of generous rating.

se the heater currents add substantial total, it is com- actice to connect several in series and operate them me convenient higher volt- is obviates the need for ook-up wire and it also e necessity for heater wind- g very heavy gauge wire.

y, the power transformer designed to operate with density in the core and be heathed to confine stray radiation. Purpose of all o prevent the beam on the ube from being deflected, de- or modulated by "hum" om the power supply.

ual fact, there is a distinct verseas toward the use of rmersless" power supplies, ers being connected in series rated through a ballast dir- m the power mains.

## ED MAINS VOLTAGE

rly, the mains voltage is directly and applied to the sion circuits of the receiver.

practice increases the hazard from the receiver but is bly justified by the fact that should tamper with a tele- receiver, other than trained el, and then only under conditions.

cheme also has a particular n in sets using "printed cir- chniques. In such cases the metal chassis gives place to n-metallic plates, suitably d together. The job of at- a heavy power transformer an assembly is quite often a one.

# HERE'S YOUR ANSWER TOM

(Continued from Page 45)

energy being wasted by upward radiation.

The signal to be radiated from the TV aerial is carried up the mast via a specially constructed feed line, and the steel mast takes no part in the radiation of energy.

But a steel mast standing some 1600 feet high would also make an excellent broadcast aerial, provided it is insulated from the ground. This was provided for in the mast in question. Note that the mast itself is used for the purpose, the TV aerials being quite distinct.

And now, why self radiating?

In broadcast practice it is also essential to have as high an aerial as possible. The early approach was to support the aerial between two or more high steel towers. The towers are insulated from the aerial proper and only serve to support the aerial, "skyhooks" not having been invented so far.

But if a vertical "conductor" is long enough for the purpose there is no reason why it cannot be used. Thus the Oklahoma City TV tower itself was made the radiating conductor or aerial, and not some other conductor attached to it. Thus, the tower itself radiates, and for convenience's sake, it is said to be self-radiating.

In actual fact, Tom, a vertical transmitting aerial has a lot to recommend it for broadcast band work, because its natural radiation pattern tends to concentrate the radiated energy where it is most needed — in the "service" area within a radius of a hundred or so miles.

# "PLAYMASTER" BABY TUNER

(Continued from page 39)

layout diagram which shows this, as well as the position of most other components. If this is used in conjunction with the circuit and photographs, no difficulty should be experienced in duplicating the original.

Power is brought to the tuner and the audio signals taken out by means of a five-pin plug and suitable cable. The plug is wired to suit the five-pin socket fitted to all Playmaster Control Units and from which the power will normally be derived. Ordinary hookup wire will serve for all bar the audio lead, which should be shielded cable. The shielding is earthed to the tuner chassis.

This cable can most conveniently pass through one socket hole in the back of the box and the aerial through the other. It is a good idea to keep these leads reasonably separated.

Alignment of the tuner is quite routine, it merely being necessary to see that the selctivity switch is in the normal position. A check on our model showed that it was 16 db down at 7 Kc in the normal position, but only 6 db down at the same frequency when in the broad position. This gain of 10 db is well worthwhile and brings the response to the point where the control unit can provide further useful compensation.

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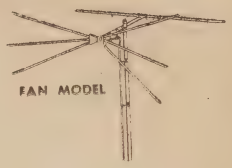


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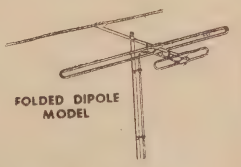


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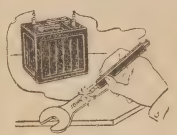

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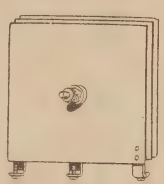

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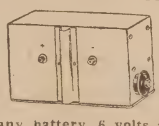

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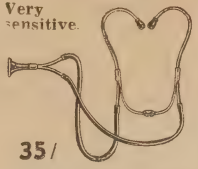

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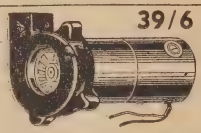

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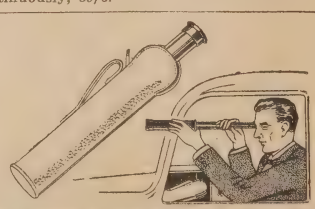

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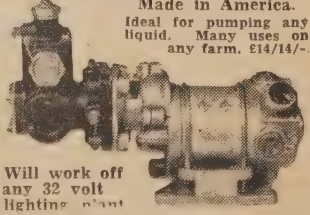

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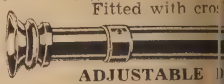

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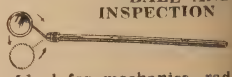

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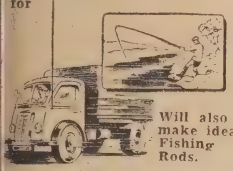

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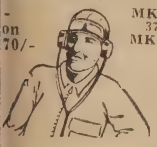

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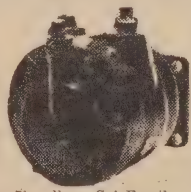

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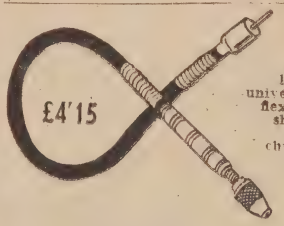


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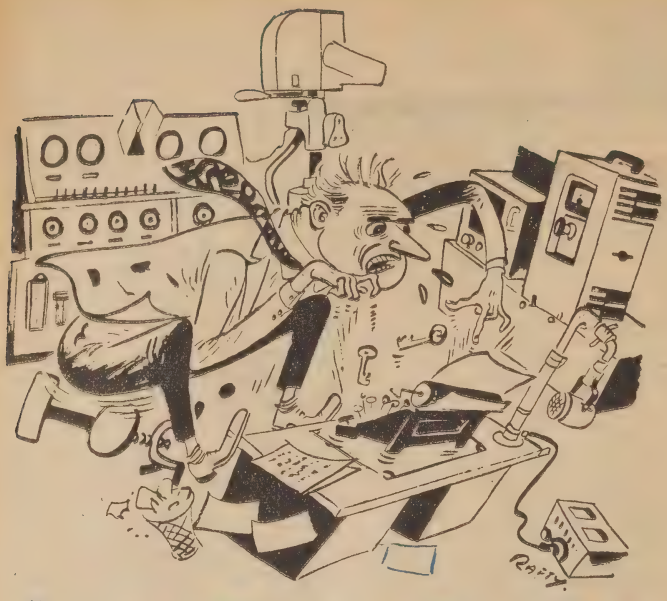


# Let's Buy An Argumen

**For anyone interested in the subjects of radio and motor cars, there was a wealth of teresting material in the lecture delivered recently by Dr. Felix Gutmann, Ph.D. M.I. before the Sydney division of the Institution of Radio Engineers. His subject . . . . "El ronic Servicing of Motor Cars."**

FOR most of those present it made interesting listening, but I imagine that, under other circumstances, it might also have provided excellent material for argument. Hence my reference to the lecture in these columns.

I personally am not the slightest bit interested in having a difference with the good Doctor, because my knowledge of ignition systems, &c., is strictly utilitarian, if one can use such an adjective in this context.

## DOES IT GO?

I switch on the ignition of the family car and note whether the ammeter shows a slight drain; if it does, I know there's current through the primary circuit.

But if the motor fails to start, I lift the bonnet, have someone else press the starter and see whether a spark can be induced to jump, via a screwdriver from the plug cap to the cylinder head.

If the spark is "weak", I try to find out why. In fact, with such an accepted technique and a set of oily overalls, you'd never pick me from a professional mechanic!

In his lecture, Dr. Gutmann expressed amazement that the auto industry had progressed so far with so little fundamental physics relating to its product and so little precise instrumentation.

Relatively speaking, he said, we know far more about the physics of the atom-bomb than we do about such a commonplace thing as an internal combustion engine.

The reason for this was not hard to find. Whereas the atom-bomb had been the outcome of pure physical research and every aspect of its development carefully "instrumented" the motor car had "just growed"

by Neville Williams

Things were an improvement cause they worked a bit better on the previous model.

The lecturer may possibly been employing some licence i pressing such sentiments or he have been prepared to stand by to the letter; I don't know. How I couldn't help feeling that we in some of the big auto res labs might not have been in plete agreement with such rem

The lecturer pointed out, inc tally, that the comparison be the atom-bomb and the events a motor car cylinder was no tirely fantastic. In the first cas energy magnification betwee bomb and its "trigger" device of the order of 10 to the pow The energy magnification be the ignition discharge and th plosive force in a modern e was also about 10 to the power

## WHAT HAPPENS

Dr. Gutmann went on to that the spark was not just an i tive "kick", in the often acc sense of the term. The action w follows:

With the breaker points c current flowed through the ig coil primary and built up arou a magnetic field. When the opened, the field collapsed a charge flowed into the cap across the points.

The circuit exhibited reso qualities, however, and develo quite definite but highly d wave train, as illustrated. Str enough, this higfhly damped train always turned out to h fundamental frequency of abo Mc. seemingly irrespective make of the car or its ignition s

Why it happened this w wasn't sure. (Another argu but V8's from America and Austins from England exhibit same order of resonance.

However, although the fun tal was fairly clearly define energy was distributed over broad band that it almost h characteristics of "white noise" a car which caused a lot of ference on an ordinary receiv likely to do the same thing a vision frequencies!

Just what part of the dampe train performed the most usefu tion in igniting the mixture wa to considerable discussion, sa Gutmann.

It was often claimed that t itial high-voltage surge was th

tant, and that, once having in- l an "explosion" in the cylinder, mainder of the wave train was consequence.

rnatively, it was often claimed the total energy contained in lischarge was significant and he initial peak was not suf- to ignite the mixture reliably.

Gutmann believed that there an element of truth in both

That the nearer the carbu- n approached perfection, the readily the gasified fuel could ited. On the other hand, where linder was filled with minute ts of fuel in air, ignition was more difficult and the spark rge had to "condition" the mix- n its immediate vicinity before d ignite it.

refore, the behavior of the igni- ystem and the demands made it related very closely to effi- of carburettion, condition of ngine, operating temperature, of the fuel, and so on.

same point emerged again in tion Time", when the lecturer sked about the effect of inter- e suppressors and so-called intensifiers".

said that many of these de- were simply resistors . . . and ould a resistor do anything but energy? Which seemed a logical stand to take.

## ENERGY

effect would be to diminish nergy in the damped wave which may not affect an effi- engine at all. On the other its effect on an engine which as aforesaid, on the total en- f the discharge, or which hadn't ng to spare in the first place, be quite serious.

Gutmann said that capacity intensifiers might possibly " by improving the impedance between ignition coil and gap, n he was far from convinced them. (Another potential ent, I'm sure).

remarks did answer my own al queries, however, about n capacitors . . . why they to give trouble on occasions hy mechanics often adopt the le that "you should replace the ıser when you renew the "

ing been brought up on radio tors at a few pence a time, accepted 400-volt ratings as ter of course, I've always felt was being "got at" by such nce on replacing a "6-volt" tor at several shillings a time. o I overstate the case?).

how, Dr. Gutmann pointed out ıch capacitors did not work in lt or 12-volt circuit, or merely ircuit subject to mild inductive ". Rather did they operate in a broadly resonant at 1.6Mc ıbject to voltage peaks as high

ther words, their rating must erms not of a few volts DC, but volts AC . . . which is higher than expected of the average capacitor.

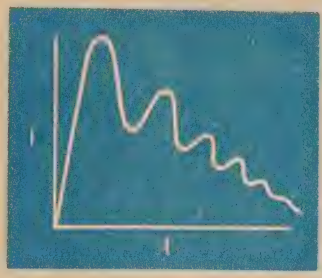
ir value was not particularly l, he said, the usual figures g around 0.2 mfd plus or minus 10 or 15 pc.

ir shunt resistance, in itself, was not very important because ignition systems would function more or less normally with as low as 50,000 ohms connected across the capacitor.

The important point was, however, that a capacitor having a shunt resistance even as low as, say, 2 to 5 megohms was suffering some degradation of the dielectric and it was only a matter of time before complete failure followed, perhaps at a most inconvenient time!

The property which did need to be watched in an ignition capacitor was its series resistance, due probably to imperfect connection between the connecting lugs and the metal foils.

Since the peak currents through the capacitor could amount to amperes, a series DC resistance of only a couple of ohms could greatly reduce the energy available in the ignition circuit and lead to poor engine operation.



According to Dr. Gutmann, the energy in the primary circuit of an auto ignition coil takes the abov form immediately after the breaker points open.

It was not sufficient, therefore, to test an ignition condenser for capacitance and leakage, as one does a radio condenser. It is necessary, by means of an RF potential, to discover any series resistance which might be present and, only after it had passed as good on all counts, could it be accepted as satisfactory.

## FAMILIAR SITUATION

I can see in this a situation loaded in the same way as radio valve testing.

A radio serviceman tests a valve and says it's bad. The customer takes it home, plugs it into a set, discovers that the set works and immediately concludes that the serviceman is a "sharpy".

In the same way, a mechanic pronounces a condenser as bad and proceeds to instal a new one, charging for both the component and the installation. The customer takes home the old one, slips it back into place and discovers that the engine still works . . . in fact it works just as well as with the new capacitor in place.

Therefore the mechanic is a "sharpy", too, and his instrument is "loaded" to sell capacitors.

It's the valve testing situation all over again. What the customer doesn't know is:

(1) The capacitance is grossly out leading to fast burning of the ignition points; or

(2) The leakage is too high, indicating that the capacitor is likely to fail in the measurable future, under the heat and rigors of its peculiar service; or

(3) The series resistance is too high, weakening the spark and making it that much harder to start the car the next time the engine is cold or the wiring is fouled with spray.

Who could have believed that so much could revolve around so simple a component as an ignition condenser.

Remind me to raise my hat next time I see one in the street!

Then there's the ignition coil, a more ponderous but no less tricky device.

Dr. Gutmann refused to be drawn on such questions as how many volts should a coil deliver, "open circuited" or "on load".

## SPARK GAP

He pointed out that there is no more variable thing in this world than the spark gap which presumably represents the "load" on a coil.

Before the gap breaks down, it is an open circuit. At what voltage it breaks down depends on such things as temperature, pressure, atmosphere, humidity, cosmic rays, radio-activity in adjacent bodies and so on, presumably ad lib.

A standard spark gap, precise enough for instrumentation purposes, would have to be set up inside a foot-thick lead box, in a controlled atmosphere, &c. Then, and only then, could you justifiably "measure" the potential delivered by the spark coil feeding it.

Since this isn't practical for a local mechanic, he has to be supplied with an instrument which activates an ignition coil at some workable frequency and measures its potential across a string of resistors and rectifiers which have been shown by practical tests to similate the characteristics of an average kind of spark plug installation. In other words, across a similated but reasonably constant reference load.

Having built a tester around a vibrator, a similated load and a VT voltmeter, the output from any given ignition coil can be measured in volts, then transferred on to one of those delightfully precise meter scales which read "Good" on one side of a certain mark ond "Bad" on the other.

## GOOD OR BAD?

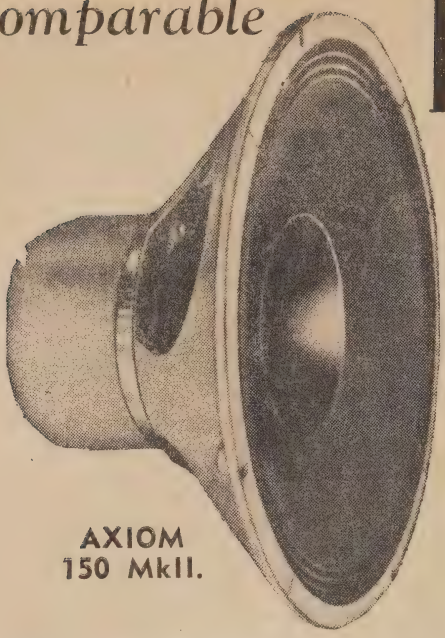
Though the demarcation between a good and a bad product cannot possibly be as precise as this, we were assured by Dr. Gutmann that such an indication was essential and that neither the mechanic-tester nor the public could be expected to interpret readings which were more ambiguous.

Personally, I think that the modern preference for these "Good-Bad" scales is as much phychological as anything.

If a qualitative test shows that a coil, a condenser or a radio valve is "doubtful" or "mediocre" or "50 pc", the customer is left in a quandary as to whether he really ought to buy a new one. Even the conscientious

*incomparable*

# HIGH FIDELIT



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**58 HIGH ST., GLEN IRIS, SE6, VIC.**

is in two minds what to

when the meter says "Good" ad", it gives a lead to both s what the decision should be, hough both are secretly aware ie meter only just read "good" y just read "bad", as the case be.

aps we should remove even lement of hesitancy by sub- ig a pair of lights for the r. Then nobody would have a s to whether the device under ist made the grade or passed lying colors.

ever, I didn't mean to get on . It's a line that should pos- ave been reserved for another te "Argument" article.

ing back to our original Dr. Gutmann pointed out that ovision of a good capacitor and lus spark plugs and wiring, ot in itself sufficient guarantee the ignation system would e efficiently.

## URE PERIOD

vas most important that the remain closed long enough for il to saturate. This did not saturation of the iron core, ither a condition where the tic field around the primary ached its maximum strength. ning of the points caused the o collapse and initiated the Once the points opened, it material how far they opened, ey could close again just as s the damped oscillation had ly ceased.

djust the distributor by set- e gap size was therefore rely- n a second-order quantity could only be related to cam angle of dwell, &c., in a nically perfect distributor.

wear became evident, even very few miles, the relation- as prejudiced.

therefore tended to set gap with the greatest of care, ig the fact that progressive n the cam mechanism and in otor bushes was gradually ng out the really critical ty and even leading to erratic or because of cam bounce

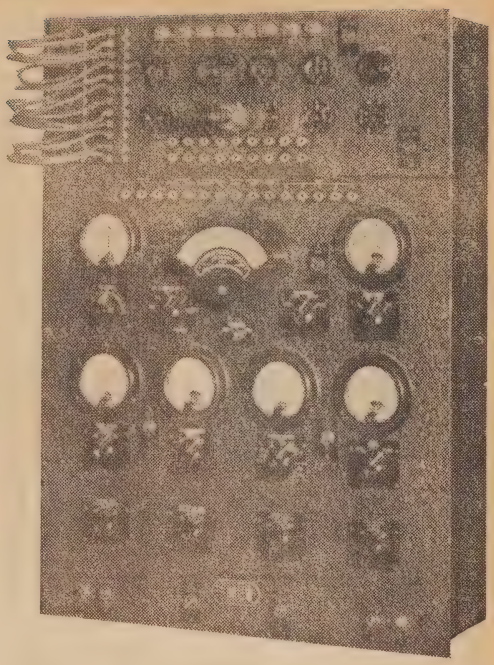
Gutmann then demonstrated amic distributor tester which ed stroboscopic means to the behavior of the points in ese respects and at varying eeds.

time you fret and worry some tiny possible error in your breaker points, you may l be aware, for good measure, ou are straining at the pro- gnat and swallowing a (Argumentative types, please n!)

## LOSCOPE?

lly, Dr. Gutmann was asked the use of an oscillograph to e the performance of a com- gnition system, operating "in n the vehicle under test."

aid that such a test could in- ield a great deal of informa- An oscillograph available from it in America displayed eight one above the other, each ing the ignition conditions in icular cylinder of an eight- r motor.



Here is the big "portable" tester, referred to in the text below. Each socket type had to be set up by plugging the patch cords, stored at the upper left corner, into pin jacks seen above the meters and in the socket panel. It was possible to test for a variety of valve characteristics under rated conditions— a comprehensive tester but Oh, so slow! Tomorrow's valve testers mightn't be so fast or so simple, either!

The difficulty was one of correct interpretation. It was not an instrument for use by mechanics who might have to spend the bulk of their time doing anything else but ignition service; who would tend to forget, in between times, what all the possible patterns might mean.

Said the Doctor, "They would have to go and look it up in a book, which would take time. Then they'd probably make a mistake anyhow!"

That's about as far as the lecture went. The Doctor didn't have time to mention gas analysers and other instruments and adjustments relative to voltage regulation, line losses and such like.

Come to think of it, an up-to-date service station looks like having to sprout an annexe that will look for all the world like a radio service shop—except that it won't be cluttered with faulty television sets.

## RADIO VALVES

Earlier on, I mentioned the subject of radio valve testing. I wonder how many readers have yet become aware of the problem which faces the manufacturers of such instruments?

Their lot has never been a happy one, as anyone will know, who has ever faced up to the design of a "universal" valve tester. They have my full, personal sympathy.

Ideally, a valve should be checked under conditions which closely approximate those in which it is most likely to be used.

This means that a tester should be able to provide an array of operating potentials ranging from several hundred volts, for a big mains-type valve, down to 70 odd volts for a battery valve and for current drains from a milliamp or so up to a hundred milliamps.

Then, according to the valve type, it may be necessary to test for transconductance, power output, impedance, gas current, and so on.

Many years ago, I remember working on a big "portable" tester which did most of these things. It could indicate quite a lot about a valve, provided you knew how to work the thing and had the time to set it up.

But it was quite unsuitable for use by radio servicemen. It was too costly, too cumbersome, too involved and too slow.

## NUMEROUS PROBLEMS

Nevertheless, the designer of a valve tester has to start with some such ideal and deliberately discard this and that and compromise this and that, until he has left an instrument sufficiently small, cheap and simple, to have some hope of it selling.

The fact that valves have to be tested under conditions quite foreign to their ratings, or simply in terms of emission, is all part of the price that has to be paid.

Having decided upon the basic electrical principles, the next problem is the purely mechanical one of making suitable connection to the valve pins.

Once upon a time, it was merely necessary to run the heater wires to certain recognised heater pins, connect other wires to the remaining pins of a few sockets in the "recognised" fashion, and that was that.

But this idyllic state of affairs didn't last for long. Valves began to appear with grids, plates, screens, cathodes, &c., brought out in a variety of patterns and testers began to

**(Continued on page 95)**

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## AR8 COMMUNICATIONS RECEIVER

12 valve. Converted to 240V A.C. Thoroughly Tested. Re-aligned Latest Ovaltone Permag Speaker Noise limiter added.

**£34/17/6**

## NEW VALVES

| | | | |
|---|---|---|---|
| 217C | £1/10/- | VR65A/SP41 | 2/6 |
| 6J6 | 17/6 | KT66 | 27/6 |
| 12C8 | 12/6 | X61M | 17/6 |
| VT501 | 12/6 | 12K8 | 12/6 |
| 7C5 | 12/6 | VT502 | 12/6 |
| EBC33 | 12/6 | 6E5 | 12/6 |
| 1H6 | 7/6 | 7A6 | 7/6 |
| 6L6 | 20/- | AV11 | 3/9 |
| VCR139A | £3/10/- | 511B | £2/10/- |
| 5AP1 | £1/7/6 | VCR97 | £2/7/6 |
| 1C6 | 12/6 | VCR138 | £2/2/6 |
| 1D | 12/6 | 832A | £3 |
| 1G4 | 12/6 | 6K7 | 7/6 |
| 1J6 | 12/6 | 1K5 | 2/6 |
| 1K4 | 12/6 | 12SJ7 | 12/6 |
| 1K6 | 12/6 | 12SK7 | 12/6 |
| 1LH4 | 12/6 | 12SL7 | 12/6 |
| 1LN5 | 12/6 | 39/44 | 10/ |
| 1P5 | 12/6 | 46 | 12/6 |
| 1R4 | 12/6 | 47 | 12/6 |
| 1V | 12/6 | 78 | 12/ |
| 2A6 | 12/6 | 809 | £2 |
| 3A4 | 15/- | 828 | £2/10/- |
| 3B7 | 10/- | 843 | £1/10/ |
| 3D6 | 10/- | 957 | 6/6 |
| 6AG5 | 9/6 | 1619 | £1 |
| 6AM5 | 15/- | 1625 | £1 |
| 6AM6 | 17/6 | 1629 | 10/- |
| 6H6 | 7/6 | 2050 | £1 |
| 6J6 | 15/- | 4307A | 10/ |
| 6J7G | 9/6 | 9001 | 8/6 |
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| 6SK7 | 12/6 | 9004 | 8/6 |
| 6SL7 | 12/6 | RK75 | 10/ |
| 6SN7 | 9/6 | RK48A | £3 |
| 6X5 | 10/- | VR75/30 | 15/- |
| 6Y6 | 17/6 | VR105/30 | 15/- |
| 10 | 15/- | VR150/30 | 15/- |
| 726A | £1/10/ | NR74 | 7/6 |
| 12A6 | 12/6 | ATP35 | 12/6 |
| 12H6 | 7/6 | 810 | £5 |
| KTW62/6U7 | 7/6 | 954 | 7/6 |

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240 Or. 110

FOR THAT TAPE RECORDER

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|---|---|---|---|
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| 5FB7 | 1/17/6 | 3AP1 | 1-15-0 |
| VCR97 | 2/7/6 | 139A | 3-10-0 |
| VCR138 | 2/2/6 | POSTAGE EXTRA | |

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| | |
|---|---|
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| | |
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erial coils .. .. .. .. .. 7/6
ned H.F. coils suit 144 MEG 4/6

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| | .. .. .. .. | 2 5 0 |
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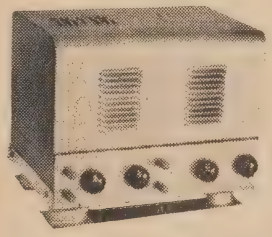

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**From £11/7/6**

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Garrard 110-80-90A, Collaro Dual—Stromberg—B

**From £15/17/6**

# RGUMENT—

Continued from Page 91)

adaptors and switches.
-the heater connections start-
tray from their recognised pins
e game began to get tough.
began to see patch-cord sys-
roller switches, multiple soc-
id hopelessly involved multi-
electors that one blindly set
sition 4" for some valves and
on something else" for other

ever, despite all the difficulties
d, test gear designers had
the position where their
mechanisms were able to ex-
n active heater pin and, say
pin, from any position on any
with a view to performing
t an effective emission test.
were therefore reasonably
nt that the resulting tester
handle any combination of
r a single or a multiple valve.
the modern tendency to con-
e same element to a number
erent pins has completely up-
apple cart. Sometimes the
e connections are made to
beneficial electrical effects:
nes they merely serve as ad-
l support points for the in-
structure.
iple leads to the cathode don't
so much but multiple leads
grid do. While the selector
extracts one grid connection
emission test, the other grid
tion remains connected to the
" side of the circuit, effec-
preventing any test from be-
ide.

## NG IT OFF

ument makers have stalled for
e by running an emission test
athode to screen in those valves
the grid could not be separ-

est against an electrode fur-
way again from the cathode
ly to be impractical, because
rent which would flow, even
ood valve, would not be suf-
to swing the meter to "good"
most sensitive condition.
even allowing that this might
pensated by a higher test vol-
t could be only a temporary
ent.
ady, I am told, a diode valve
peared with multiple connec-
o each electrode, which simply
any attempt to isolate elec-
by ordinary rotary selector
es.
ems that any future "Univer-
alve testers will have to use
of four-position lever switches,
r each possible connection to
ket or cap. Each will have
individually manipulated, ac-
g to whether the electrode it
nts must be kept neutral, con-
to the heater supply, connec-
"earth" or to the emission test

t's more, every lever would
o be manipulated individually
form a shorts test, and refer-
nade to see what groups of
es should or should not show a
on any particular valve type.
e manufacturers might have
st reasons in the world for
cating their base connections
certainly makes life difficult
eryone concerned with testing
roducts, once they go into ser-


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METALLISED PAPER-PRINCIPLE
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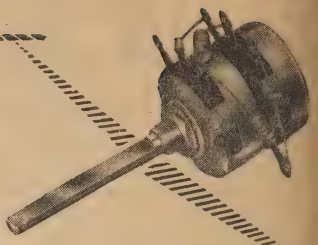
P12

IRC
AUSTRALIA



# FIT

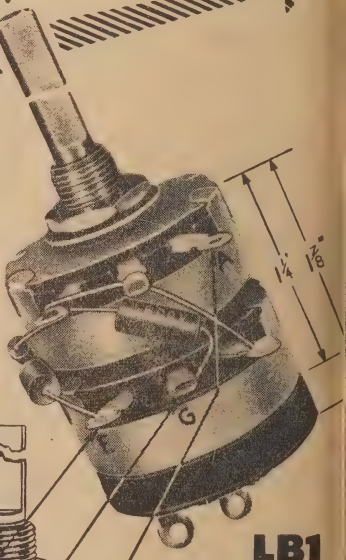
**New type LB1 Continuously Compensated Variable**

# LOUDNESS CONTROL

## TO YOUR RADIO OR AMPLIFIER

**...and automatically keep the proper balance of all frequencies within the audio range at ANY listening level!**

(Patent Applied for No. N11262)



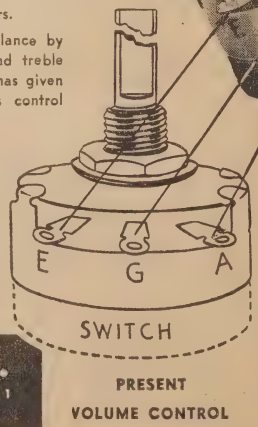

For many years there has been a need for a volume control in audio systems which would automatically keep the proper balance of all frequencies within the audio range at **any** listening level. I.R.C. has developed such a control, known as the LB1, to meet this need.

With the loudness control it is possible to reduce the output volume of any good or average audio system to a whisper and still be able to hear every tone with perfect balance, as the LB1 **provides gradually increasing high and low frequency boost** as the volume is reduced to offset the deficiencies of the human ear, **which is insensitive to high and low frequencies at low volume.** This accounts for the reason why many audio systems are operated at such high levels to give the best listening effect and in this process they become annoying to other members of the household and neighbours.

Many attempts have been made to obtain correct tonal balance by means of tapped volume controls, various types of bass and treble boost circuits and stepped type loudness controls, but none has given the performance of a truly continuously variable loudness control such as the new I.R.C. LB1.

The I.R.C. new loudness control consists of two separate volume controls operated from a single shaft of standard size and used with a combination of capacitors and resistors which are already wired. The unit will replace any volume control by transposing 3 simple connections, as indicated by the illustration at right. Can be fitted without experience.

Contact your usual supplier for illustrated literature.

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Available in I r
500,000 ohms,
or without switc
Other values
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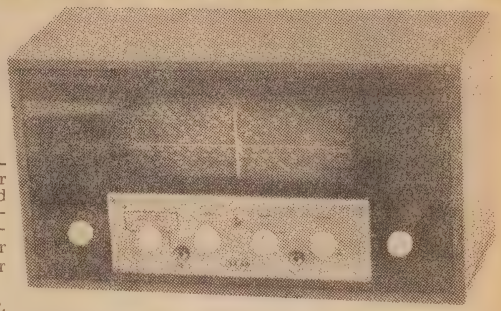
# TRADE REVIEWS AND RELEASES

## NEW WIDE-RANGE TUNER



interest to all audio enthusiasts is a recent ouncement by the Amplasound Co. that they now marketing a commercial version of the ular R, T and H "Wide-Range Tuner No. 2".

in the original design, the features a two position selec- switch, band-pass aerial sys- and cathode follower whistle Valve complement is: 6AN7 ncy changer, 6N8 IF amplifier, or and AVC, and 6BD7 output ie follower.

tuner is built on a special s in such a way as to allow any popular control units, includ- ne Playmasters, to be housed diately beneath the dial. When ing knobs are used a very neat t results.

It may be purchased separately or in a polished wood cabinet (illustrated), which is available in either maple, walnut or rosewood timbers.

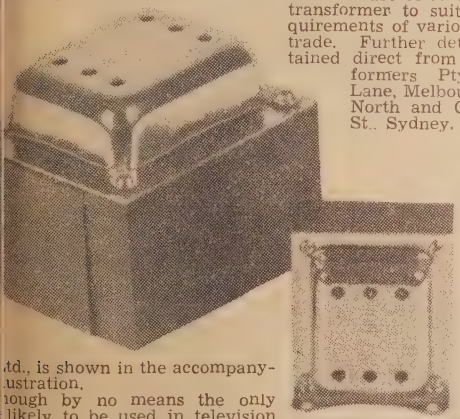
Tested on the air, the tuner performed extremely well and there was no doubt as to the effectiveness of the wide band system. In conjunction with the ribbon tweeter (described elsewhere) and a Leak amplifier, its performance was quite impressive.

Further details and price from the makers, The Amplasound Co., 126 Buckingham St., Sydney.

## IRONCORE TV TRANSFORMERS

ication of the present trend is levelopment of special trans- rs and chokes for television re- s and a typical pair of these, ped by Ironcore Transformers, for the transformer and £4/15/9 for the choke.

The manufacturers emphasise that they are willing to undertake the manufacture of other versions of this transformer to suit the specific requirements of various sections of the trade. Further details may be obtained direct from Ironcore Transformers Pty. Ltd., Higson Lane, Melbourne. C.I., or Wm. North and Co., 279 Clarence St., Sydney.



☆

The transformer (left) and choke specially designed for TV receivers. Both are well made and attractively finished in nickel and black.

☆

td., is shown in the accompany- ustration.

ough by no means the only likely to be used in television uction, they are typical of being specified by manufac- at the present time. Similarly, type most likely to be avail- o the home constructor when he building.

transformer has been design- produce a minimum external tic field as precaution against rence with the picture tube ion, and this includes a copper around the winding.

primary winding is multi-tap- o accommodate line voltages 200 to 240 and the HT winding V at 250 mA. The filament ngs are: one at 19V. 1A., one at A. and one at 6.3V, 5A.

se apparently odd filament es are intended to permit series ion of various valve groups, educing the amount of current g in that filament line.

ail prices are quoted as £12/6/-

## KELLY RIBBON TWEETER

**Yet another contribution to the problem of improved loudspeaker performance is the Kelly Ribbon Tweeter, recently made available to the Australian market. Of English manufacture, it is being made available in Australia through Simon Gray Pty. Ltd., Melbourne.**

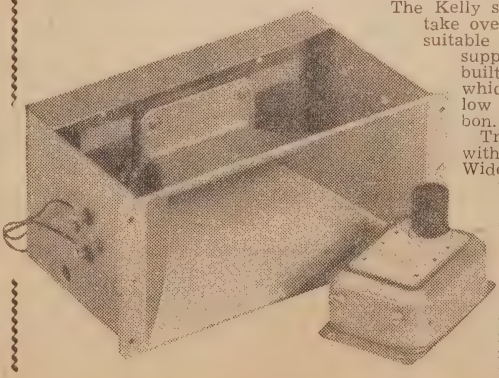
The basic principle of the ribbon speaker is similar to that of the ribbon microphone, only working in reverse. However, the efficiency of a ribbon microphone would be too low for use as a speaker and it is the production of a suitably efficient unit which is one of the achievements of this instrument.

A feature of this principle is that the driving force is applied equally to all parts of the ribbon, rather than to a small area, as in the case of the moving coil system. The result is a substantial reduction in standing waves and associated distortion.

The Kelly speaker is designed to take over from 3Kc up, and a suitable crossover network is supplied. A transformer is built into the speaker which matches the very low impedance of the ribbon.

Tried in conjunction with the Amplasound Wide Range Tuner and the Baby Wide Range Tuner it gave a very good performance. The response appears to be particularly smooth and free from serious peaks.

Further details are available from the agents, Simon Gray Pty. Ltd., 28 Elizabeth St., Melbourne.



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**Engineered by the world's most outstanding High Fidelity technicians. Each unit has been subjected to the most rigid final test, assuring you of the ultimate in HI-FI performance.**

## The British ARMSTRONG SUPER 10

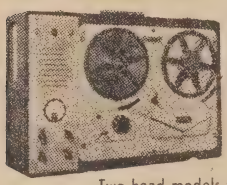
High Fidelity Amplifier and pre-amp control unit embodying

- ★ Six-way audio filter.
- ★ 15 db bass and treble boost controls.
- ★ Four way pick-up equalisation control.
- ★ Four separate inputs for high and low impedance pick-ups, radio and mike.

Control panel in handsome florentine bronze.

£79/10/-

## VORTEXION PROFESSIONAL PORTABLE RECORDER



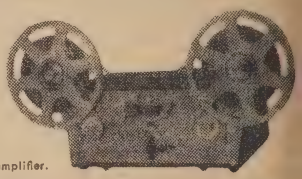
Uses the famous Wright & Weaire deck plus these new features:

- ★ Vortexion Low Noise amplifier.
- ★ Adjustable bias setting to compensate for various tape characteristics.
- ★ Synchronous capstan motor.

Two head models from £199 Plus Tax

## Magnecorder Three Speed Tape Recorder

The only three speed professional unit.



- ★ 10 watt broadcast amplifier.
- ★ Plug-in equalisers.
- ★ Amplifier flat to 20,000 cycles.
- ★ Suitable for rack mounting.
- ★ Studio type VU meter.
- ★ Heavy duty studio type synch motors.

The world's most widely used recorder! From . . . . £299 Plus Tax

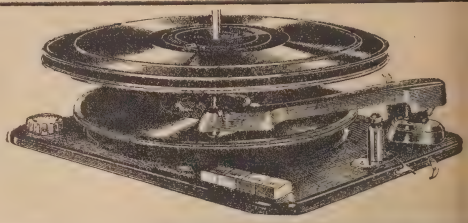
## MIRACORD XA 100

Now the most widely sold changer in U.S.A. and the only changer in the world with all these features.

Three Speed — push button — fully automatic features with — Auto repeat, auto reject, auto interval, auto filter, and instant conversion to manual.

With crystal cartridge head . . . . . £39/10/-
With variable reluctance turnover cartridge and four pole motor £54/10/-

All models intermix all three sizes 12in, 10in, 7in.



## TRUVOX TAPE DECK

Build your own amplifier to the British Truvox circuit design, furnished free with each deck.

2 SPEEDS

£57/15/-

## ★ BASF Megnetophon Recording Tape

| | |
|---|---|
| ★ 1800′ on 7″ spool | £4/15/6 |
| ★ 1200′ on 7″ spool | £3/7/6 |
| ★ 600′ on 5″ spool | £1/19/6 |
| ★ 400′ on 4″ spool | £1/14/- |
| ★ 213′ on 3″ spool | £1/1/- |
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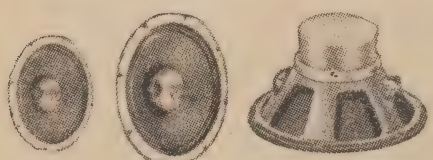
## ★ PRE-RECORDED TAPE

FLORENCE MAY FESTIVAL series of pre-recorded classics on tape. Eighteen of the master classics recorded in Vienna and now available to music lovers on high fidelity tape.

Write for special concession catalogue offer.

| | |
|---|---|
| Single Track Recordings | £4/17/6 |
| Double Track Recordings | £6/15/- |



## ★ PEERLESS SPEAKERS

The Danish PEERLESS Twin Cone and Co-Axial Speakers. Flat 2db 40-15,000 cycles.

- ★ Twelve inch co-axial with in-built 5in. tweeter and cross-over unit . . . . . £16/17/6
- ★ Twelve inch Twin Cone . . . . . £8/5/-
- ★ Eight inch Twin Cone . . . . . £5/18/6

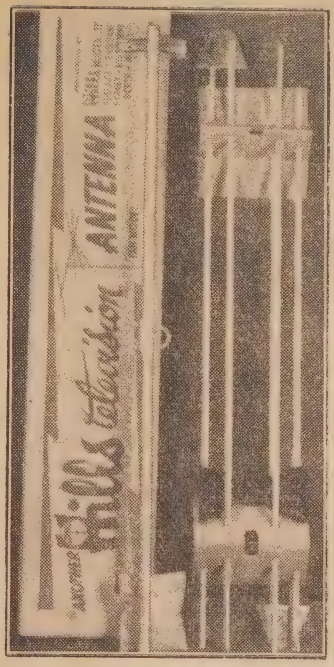
NOTE: All prices shown are given as at date of publication and are subject to change without notice.

**Magnecord Australasia Pty. Ltd.**

Kyle House, 31 Macquarie Place - - - Sydney

# 'V AERIALS FROM HILLS HOISTS

manufacturers of the well vn Hills Hoists have made her progressive step in pre- ing a range of television nnas, which are backed by heir resources from manu- uring through sales, service and installation.




e units will be marketed h the normal trade channels s television set manufacturers, al wholesalers and retailers nstallation companies. They a free 12 months' insurance against such risks as personal fire, &c, and are covered with conditional guarantee against workmanship and materils.

' technicians have appreciat the antenna is the vital link n the transmitter and the re- set and have taken pains out a first-class article suit- or receiving signals on all ls allocated to Australian tele- stations.

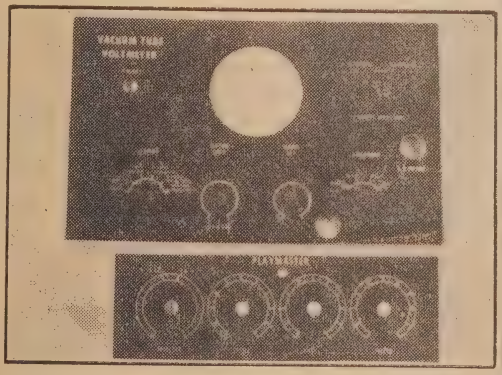
designs are currently avail- The fan type and the folded The fan type is cut to reson- 65 Mcs and uses third har- sensitivity for the higher It is designed for use with m cable.

folded dipole uses two dipoles, t to 195 Mcs and the other at . It is also designed for 300 able.

oth designs the mast and boom galvanised steel tube and the elements of ¼in OD fully hard aluminium. Fittings are of aluminium and cadmium-plated steel.

# NAMEPLATES FOR R, T & H DESIGNS

particular interest to the home constructor is the fact that a number nanufacturers now appear to be producing ready-made labels and ls to suit a number of Radio, Television and Hobbies designs.



oles of a of such have recent- submitted to Homecrafts d. They are ised alumin- d are finish- naroon with ettering, but is a possi- that other may be d should nand justify

esent avail- e designs for units No. 4, 7, as well as el for the described e January, 1956, issue. atter will be particularly wel- ince panels for this kind are pensive to have engraved by Prices for the control unit re 22/6 and for the VTVM.

r large labels for other radio, on and hobbies designs may be subsequently produced, provided there is a reasonable demand. Naturally the first cost, covering art work, negatives, &c, is rather high and is only justified if a reasonable turnover is assured.

Readers interested in other designs should contact Homecrafts Pty. Ltd., 100 Clarence St., Sydney.

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# OFF THE RECORD — NEWS & REVIEW

**Reports from the United States indicate that there is a small but growing interest there pre-recorded tapes. Though it is most unlikely that the new medium will ever have the m sales appeal of the disc, there is apparently enough interest in it amongst fidelity-conscio music lovers to make it a profitable selling line.**

*by John Moyle*

WHILE there is little doubt that pre-recorded tapes can give very excellent results, the real problem is not so much the medium itself but equipment on which to use it.

To own a "tape recorder", in the usual sense of the term, is no answer.

The vast majority of commercial tape recorders are utilitarian devices which have the same standard of reproduction as a medium-sized mantel set and for the same basic reasons. The amplifier system is very modest, the output transformer is small, the speaker unpretentious and the degree of baffling quite inadequate for extended bass response.

To spend a lot of money on a high quality tape, then play it on such equipment, is plainly futile.

And merely to divert the output into a large amplifier system may not be sufficient. Inexpensive replay heads are prone to severe high frequency losses and to gap alignment errors. Accurate compensation must be provided, as distinct a more or less arbitrary amo boost or cut, as the case m rant.

It seems unlikely that more a handful of music lovers in tralia at the moment have adequate tape replay facilities can't help wondering whethe position is proportionally muc ter in the US.

Until music lovers can b adequate replay deck compara price and performance with sonable quality pickup and the future of pre-recorded tape remain obscure.

In the meantime, most of pretty happy with the man discs which are currently bei leased.

**MOZART — Sonata in major K284, Fugue in G m K401, Sonata in F major K Allegro of a Sonata in G m K312. Played by Walter Gi king. Volume Six of Moz Piano Works. Columbia 330 1271.**

After the high standard of king's Debussy records we been hearing of late, there isn pleasure in reporting that his as heard on this record reach the same pitch, althou naturally apply the strictest ards to a pianist of this em

My criticisms concern the ties of performance — a tende unevenness in many of the tur graces, a perfunctory appro some passages, a hurried over of a phrase which coul been much more gracious thoughtful.

I fear that too often the sion on my mind is that he playing through.

I don't mean that there profit in the record — that be quite wrong. The Rondo major and Allegro in G minc some delightful moments, a I don't think any of the item are free from my criticisms.

It's really one of those discs your own judgment is best — fear you will agree with m often his heart doesn't seem in it.

Try it and see.

The recording is acceptabl out being brilliant. Surface very low. Use the RIAA cur

**BEETHOVEN— Thirty Variations in C minor; Six telles Opus 126. Playe Leonid Hambro pianist. 1039.**

Hambro is a brilliant pi dealer in crystal clear fi pace, and strong dynamics.

I felt he would have bee successful if he had shown r straint in using his full pow often he goes through th with an electric burst which


A FEAST FOR VALENTINE FANS!

**"Here is DICKIE VALENTINE"**

Singing — entertaining — impersonating Nat "King" Cole, Johnny Ray, Mario Lanza, Al Jolson, Billy Daniels, Billy Eckstine and Edward G. Robinson.

The *greatest* record you've ever heard; a "live" performance, recorded by Decca, L/P, in brilliant full frequency. Enjoy with the audience the infectious fun of Valentine's one-man music hall.

ffrr

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| SIDE ONE: | SIDE TWO: |
|---|---|
| Band 1. Fate | Band 1. Night of My Nights. |
| Band 2. Not Since Nineveh. | Band 2. Bored. |
| Band 3. Baubles, Bangles and Beads | Band 3. The Olive Tree. |
| Band 4 Gesticulate | Band 4. Rahadlakum. |
| | Band 5. And This is My Beloved. |
| | Band 6 Sands of Time |

**AVAILABLE NOW FROM ALL RECORD RETAILERS**

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mpressive, but which many
t accept.
things need more than just
a flashing pair of hands.
re is a performance which
e easily overlooked, despite
of subtlety. If he could
less showmanship and
ught he would do well.
ecord has an undeniable
cause the music is so rarely

cording deals well with the
plosive moments, but the
e is often hard.
is a slight surface rustle,
aps to a moderate average
level.
way in which the technical
s of the piano have been
however, it is remarkably

**WOUT AT MARDI GRAS**
**Bender for Insomniacs**
**d Konitman's band with**
**avilla. Seven numbers.**
**084.**

ty recording made at New
although whether it was
the last night of Mardi
subsequently isn't clear.
terrific band, and the pace
the way through. It has
of the Jazz at the Phil-
air, except that the crowd
and less audible, and the
ceive much more technical
what appears to be a con-
erformance.
villa is the clarinetist, the
he show, and he is just
good as anyone I've heard.
I am a connoisseur.
amp, pianist of some re-
ins the group in several
without being specially
t.
cording not only has an
te atmosphere, it is also
ll and authentic. It is, in
of the most impressive
its kind yet released here.
Dixieland fiends must have

n a disc of this nature,
stly recording level is high,
f surface noise is impres-

highest level, however,
t be prepared to swap a
atmosphere for the better
studio will give. To my
thinking, this atmosphere
make the disc.
natters, the jacket design
ity.

**AVINSKY—Symphony of**
**played by the CBS**
**ony Orchestra of America;**
**ire du Soldat, Concert**
**Conducted by Igor Stra-**
**Philips ABL3065.**
vinsky is for you, then you
t this record, for it con-
of the composer's most
works on a single disc,
rformed and recorded, and
under Stravinsky's own

be doubtful whether he
d a conductor of his own
are some others. I remem-
rather disappointed with
cting of the Rite of Spring
t the prevailing competi-
the other hand he should
st how his music should

cca recording of the Sym-
Psalms conducted by An-
rovides an absorbingly in-
contrast — I feel that it
more impressive effect than
record, which is much


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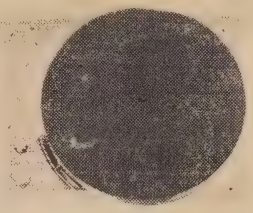

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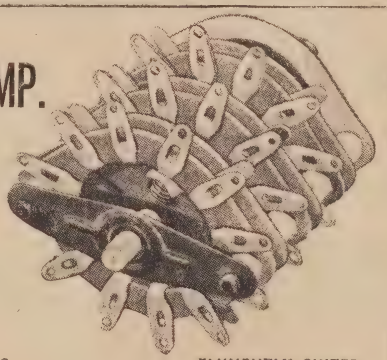

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**Prim.: 4500 ohms P.P.**
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**Resp.: 10-60,000 cps.**
**Valves: EL37, KT66, 6L6, etc.**
19% Screen Taps.

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**TYPE 931-8: 20 watts.**
**Prim.: as 931-15.**
**Sec.: 2 or 8 ohms.**
**Resp.: As 931-15.**
**Valves: As 931-15.**
19% Screen Taps.

---

**TYPE 921-15: 20 watts.**
**Prim.: 6600 ohms P.P.**
**Sec.: 3.7 or 15 ohms.**
**Resp.: 10-60,000 cps.**
**Valves: 807, KT66, etc.**
19% Screen Taps.

---

**TYPE 921-8: 20 watts.**
**Prim.: As for 921-15.**
**Sec.: 2 or 8 ohms.**
**Resp.: As 921-15.**
**Valves: As for 921-15.**
19% Screen Taps.

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**TYPE 916-15: 12 watts.**
**Prim.: 8500 ohms P.P.**
**Sec.: 3.7 or 15 ohms.**
**Resp.: 10-50,000 cps.**
**Valves: 6BW6, 6V6, KT61, etc.**
19% Screen Taps.

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**TYPE 916-8: 12 watts.**
**Prim.: As 916-15.**
**Sec.: 2 or 8 ohms.**
**Resp.: As for 916-15.**
**Valves: As for 916-15.**
19% Screen Taps.

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**TYPE 949: 12 watts.**
**Prim.: 8000 ohms P.P.**
**Sec.: 2, 8, 12.5 and 15 ohms.**
**Resp.: 10-50,000 cps.**
**Valves: 6V6, 6BW6, KT61, EL84, etc.**
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## SPECIAL HI-FIDELITY

+—1 db 20-40,000 cps

**OUTPUT TYPE**

**TYPE 870 — 6 watts.**
**Prim.: 10,000 ohms P.P.**
**Sec.: 2 or 8 ohms.**
**(for "Rola" 120X)**

---

**TYPE 871 — 12 watts.**
**Prim.: 10,000 ohms P.P.**
**Sec.: 2 or 8 ohms.**

---

**TYPE 872 — 12 watts.**
**Prim.: 10,000 ohms P.P.**
**Sec.: 3.7 or 15 ohms.**

## HIGH FIDE

+—1 db 30-15,

**OUTPUT T**

**TYPE 763 — 1**
**Prim.: 5000, 300 P.P.**
**Sec.: 15, 12.5, 8, 2 ohms.**

---

**TYPE 920 — 1**
**Prim.: 5000, 300 P.P.**
**Sec.: 500, 250, and 100 oh**

---

**TYPE 897 — 1**
**Prim.: 10,000, 80 P.P.**
**Sec.: 500, 250, and 100 oh**

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**TYPE 896 — 1**
**Prim.: 10,000, 80 P.P.**
**Sec.: 15, 12.5, 8, 2 ohms.**

**LOOK FOR THE SILVER-GREY TRANSFORM**

## MEDIUM FIDELITY

+—2 db 50-12,000 cps

**TYPE 809 — 15 watts.**
Prim.: 500 ohms.
Sec.: 15, 12.5, 8, 3.7 and 2 ohms.

---

**TYPE 914 — 15 watts.**
Prim.: 5000, 3000 ohms P.P.
Sec.: 500, 250, 166, 125, and 100 ohms.

---

**TYPE 915 — 15 watts.**
Prim.: 5000, 3000 ohms P.P.
Sec.: 15, 12.5, 8, 3.7 and 2 ohms.

---

**TYPE 917 — 15 watts.**
Prim.: 10,000, 8000 ohms P.P.
Sec.: 500, 250, 166, 125 and 100 ohms.

---

**TYPE 918 — 15 watts.**
Prim.: 10,000, 8000 ohms P.P.
Sec.: 15, 12.5, 8, 3.7 and 2 ohms.

---

**TYPE 922 — 25 watts.**
Prim.: 800 ohms P.P.
Sec.: 500, 250, 166, 125 and 100 ohms.

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**TYPE 891 — 25 watts.**
Prim.: 6600 ohms P.P.
Sec.: 500, 250, 166, 125 100 and 83 ohms.

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**TYPE 892 — 55 watts.**
Prim.: 3200 ohms P.P.
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**plus 2db 50 — 12,000 cps. TYPE 928—5 watts.**
Prim.: 7000, 5000 ohms.
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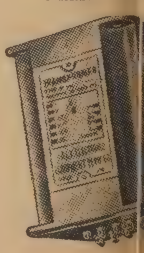
Prim.: 4000, 2500 ohms.
Sec.: 15, 12.5, 8, 3.7 and 2 ohms.

**TYPE 930 — 1**
Prim.: 4000, 250
Sec.: 500, 250 ohms.



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**A. & R. ELECTRONIC EQUIPMENT PTY. CO. LTD. MELBOURNE. V**

orward, and accentuates the romising outlines quite mer-

ing so, however, it presents ery good and effective sound, s with an authentic wide- atmosphere. But Ansermet greater breadth.

L'Histoire du Soldat, heard its Concert Suite form, has re no vocal part. To me it istakably ballet, truly music eard, sung or danced. Echoes Petrouchka period are numer- t it has a bitter, ironic air nly Stravinsky can achieve, ich is so unsuccessfully imi- y clever but less talented ers.

score is a miracle of econo- writing—only seven instru- are used, and they give the sharply defined outline which cularly effective.

marks, then, for an import- The surface and general ng are high class — you can em for granted.

**OZART—Symphony No. 35 major (Haffner) K385; Sin- Concertante in E flat major Violin, Viola and orchestra Played by the Mozart rs conducted by Harry , with Norbert Brain n) and Peter Schidlof ). HMV OCLP1014.**

ven't any other "Haffners" parison, although there must e somewhere. They would be good to head this record much, for although it may master's touch, it is ex- pleasant to hear, and is ly and honestly played.

will have to listen carefully t minor laxities in precision. h the last movement is play- st leisurely if we pay atten- the Presto as marked, there thing less than perfection at

matter of fact its quieter nt doesn't sound at all bad music is good enough to t, and it's much better to down than to achieve a mad e. Not that the Mozart have selected their pace by y!

Sinfonia has a different o it, probably due to micro- lacement to accommodate the

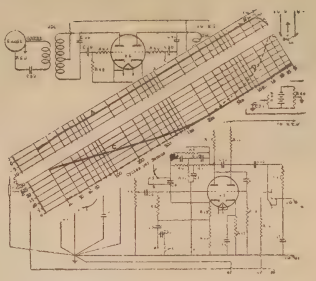
are both first rate—actually s of the Amadeus Quartet. a first rate piece of work which you need have no re- ns at all.

recording comes through a blemish with the excep- a pop on one side which e is just an unfortunate spot pressing. Obviously it isn't orchestra, but it is far enough e mikes to blend well—a little ch perhaps if we are super- Both solo strings in the balance well and the sur- a quiet one.

EMI or RIAA curve.

ntally this orchestra will be G. W. Briggs for a demon- of recorded music versus rformance in the Festival ondon, early in May. This nost ambitious demonstration empted by Mr. Briggs, who erved a couple of seats for the night. Needless to say looking forward to it very


# NEW TAPE CIRCUITS



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# SHORT-WAVE NOTES BY ART CUSHE

## THE "VOICE OF CIVIL DEFENCE"

### A new Philippines station, announcing as the Voice of Civil Defence has been heard on 3365Kc.

BROADCASTING on the same channel as the new DYRI DYI-2 transmitter at Iloilo City, a new Philippine station has been logged from as early as 7.30 pm The station gives a Manila address, but after listening to several broadcasts, we presume that the transmitter is the DYI2 station, with this special program of government information.

The station has identified as "This is the Voice of Civil Defence, broadcasting from Iloilo City" so it would appear that this programing is a regular feature of DYI2.

Using the slogan "The Voice of National Defence" a station with a like program, was logged and verified in 1941 before the Japanese invasion This station broadcast from Manila and used 8790 and 9510Kc We at once recalled this station when the Voice of Civil Defence was heard, as the Government operating department appears the same.

Civil Defence broadcasts mainly news on government bills, income tax and other official information. The Civil broadcasts have been heard to 10 pm, after which the DYI2 transmissions are on the frequency to sign off at midnight. DYI2 relays DYRI and operates on the frequency for 10 hours each day.

### New German Transmitter

LATE March saw the first test of the second Cologne transmitter used in the Deutche Welle broadcasts. The new transmitter is used in all the Overseas broadcasts and following the successful test went into regular operation on April 1. The new schedule, with the latest new transmitter listed firstly in each case is — FAR EAST 8.00-11.00 pm on 15405, 15275. NEAR EAST 12.30-3 30 am on 17815 and 17845. AFRICA 4.00-7.00 am on 11945, 11795. SOUTH AMERICA 8.00-11.00 am on 11945, 11795 NORTH AMERICA 11.30 am-2.30 pm on 9735, 9640Kc. Reports would be appreciated by the DX Editor of Deutche Welle, A C. Krieger.

### New Brazilian Programs

THE recent appearances of programs from Brazil on frequencies known to be operated by another station has been clarified by Roger Legge, a US listener, who has provided us with the information.

Several Brazilian networks which have control over a number of stations have leased these to other broadcasting organisations, who simply program the material to the transmitters. The clarification of this point has made it possible to find the reasons why some days a slogan is used by one station, which is not allocated to the frequency.

Sao Paulo on 6125Kc which we reported last winter announces as "Radio Nacional de Sao Paulo" and relays PRG9. The transmitter is owned by Radio Excelsior but is leased to and programed by Radio Nacional. PRB21, 6055Kc and PRB23 15135Kc announces as "Radio Panamericana" and relays PRH7 on 620Kc.

PRB24, 11965Kc announces as "Radio Sao Paulo" and relays PRA5 on 1260Kc. PRB21, PRB23 and PRB24 are owned by Radio Record, but are leased to and programmed by Radio Panamericana and Radio Sao Paulo.

ZYC, 15370Kc relays PRG3, 1280Kc but is announced as "R. Tamoio" which owns the transmitter. The PRG3 station is Radio Tupi

Notes on listeners' new loggings should be sent to Arthur T. Cushen, 212 Earn St., Invercargill, NZ. All times used are Australian Eastern.

### Portugal Uses 13 Metres

Two 13-metre frequencies are being used by Radio Nacional Lisbon during the transmission from 8.30 pm and both have been heard here at fair strength, though the signals can be expected to weaken as we near mid-winter conditions. The 21700Kc frequency is the better signal but the interference from GVS London on 21710Kc is rather severe. The complete schedule as listed by World Radio Handbook is:—

8.30-11.00 pm on 21495 to Timor.
8.30-11.30 pm on 17880 to Macao.
8.30-11.30 pm (to 3.00 am Monday), 21700 to Angola, Mozambique.
11.30 pm-3.00 am on 15125, 11.45 pm-2.45 am on 17880 to India, Goa.
3.00-3.45 am on 17835, 21700 to Kenya, Uganda.
3.45-5.15 am 21700, 3.45-6.00 am 17835, 3.45-7.00 am on 15125 and 6.15-7.30 am on 11915 to Angola, Mozambique, S. Tome
7.30-10.45 am on 11915 North Atlantic.
7.30-10.45 am on 15125, 8.00-11.30 am on 11840 to Guinea, Brazil.
11.00 am-1.30 pm on 9775 to USA, Canada.
11.45 am-1.30 pm on 9635, Pacific Coast.

### Monrovia Verifies

ELWA, Monrovia, Liberia has confirmed the reception of their broadcasts by George Hughes, Hilton, South Aust. and in doing so send some interesting details about this new missionary broadcaster in West Africa. ELWA operates on 4835 Kc operates daily 4.45-7.00 pm, 5.45-7.15 am. Sunday 5.45-9.15 pm, and 5.45-9.15 am, using 10,000 W. ELWA Box 192, Monrovia verifies with a blue card, and also sends a photo of the station and some Liberian stamps.

## NEW SHORT-WAVE MUSICAL SHOW

The Voice of America's new musical show, Music USA, is now a feature of several of the VOA transmissions and is carried to a world-wide audience. The show, which is two hours of the best in American popular music, is transcribed in Washington.

The complete schedule is:

FAR EAST—8.00-10.00 pm on 9590 Kc. Midnight-3.00 am on 6075, 9650, 15130, Kc.

EUROPE—5.00-6.00 am and 6.00-700 am on 7235, 9590 11890 Kc.
8.00-10.00 am on 7235, 9500 Kc.

LATIN AMERICA—11.00 am-noon on 9530, 9650, 9725, 11790, 11890, 11900 15270 Kc. Noon-1.00 pm on 9530, 9650, 11790, 15270. 1.00-3.00 pm on 9515, 9725, 11870, 11900, 15240 Kc.

## FLASHES FRO EVERYWHERE

BBCs Pacific Service has bee timed to its winter schedule an operates 4.00-5.00 pm. Two re new frequencies of 11945 and are used. The complete transmis beamed to Australia on 11960, and New Zealand on 11945, 15210K gram highlights are the BBC ne 4.00 pm and Radio Newsreel at 4.

BRITISH SOLOMONS station using 5960Kc is now being much bet ceived due to the vacating of the frequency by Radio Free Europe is heard 5.00-6.00 pm Monday to day on 5960Kc and on Wednesday pm when a local language progr broadcast. VQO sign off is usua a lady announcer, and local time is as one hour ahead of Australian ti

SUDAN'S Radio Omdurman, wh frequently heard in this area is now two frequencies, 5000 and 6200K Arabic 2.15-3.30 pm (except Friday 1.30-3.30 am. English is broadcast 2.00-2.30 am On Sunday an add transmission 6.00-7.00 pm is carr Arabic, also 5.30-7.30 Friday. A for reports is PO Box 522, Kha Sudan.

SINGAPORE'S Forces Broad Service, operating on 5010 Kcs now off at midnight, with programs in an Indian dialect. Radio Au reports that the closing theme is bye, By Bye for Now" sung w Indian dialect except for the refr

Forces Broadcasting Service is tioned in English during the closi nouncement. In closing, Indian ide tion is followed by God Save the

SOUTH AFRICA'S new sho centre is progressing and this new will commence National broadcast Bloemfontein in May, after which ment for the International servi be installed. The International is expected to begin before the the year.

BENGHAZI'S Forces Broad station has dropped 4930Kc for th ing broadcast, reports ISWC, and on 3305. Signs off still 7 am and ing heard at good strength in the Kingdom. Uses 4930Kc only for the ing transmission, heard here 3.00-4

### Unknown Listener

LISTENERS often look at the lo and seeing a report unanswer station as the months pass. t a poor opinion of the station co Many times it is not the station as was so kindly shown to us Program Manager of 2CH in In their mail, as is not unc came a report from a New Zeal tener, unsigned and without any 2CH are to be commended on t terest and their appeals to us in the matter, we hope, will add verification to some listener's log ers, please remember to put yo and address on the report. Y have thought that you exhauste store of unprintable thoughts ab station in question, and woul added another station to your discourteous people, but the fau be yours.

### Colombo on Two Frequencies

The usual midday transmissio Commercial Service of Radio Ce been noted on two frequencie opening at 11.30 am, on 15120 and BBC news is relayed at noon. F months the second outlet, of mu power was in the 41 metre ban appears now to be on 11770, 100Kw transmitter on 15120Kc.

# HE HAM BANDS WITH BILL MOORE

## RECORD SHATTERED ON 50 MEGACYCLE BAND

**apid increase in sunspot activity is improving propagation condi- on the higher frequency bands. The possibility of extensive 50 mc/s distance communication is again creating interest among radio amateurs.**

DING to JA1EC the world's nc DX record was shattered in ch when Yasuo JA6FR contact- LU stations. The previous re- s made in October 1947, for a between J9A00 in Japan and in Chile, a distance of some iles. These new contacts with a extend the old record by iately 500 miles. It was antici- iat 50 mc/s would be opening in 1956. Undoubtedly many of icts of 1947-1950 will be repeated. mproved techniques and equip- ntacts should be more numerous. iately since the last peak the band has been lost to Tele- n Europe. However, in the s, Africa and Asia the band re- tact.

2 layer peaks during ionospheric ices makes these contacts over tances possible and already the iigh as 54 mc/s has been recorded of the Pacific.

writing the foregoing the 50 nd opened for long periods be- Japan and Australia over the veekend.

pening corresponded with ex- aurora displays visible in many South Eastern Australia. It had ted in the previous peak that were recorded over long dis- ring aurora activity — these were n-South paths.

### ER WORK

urs pioneered the use of this propagation in America, opera- en MUF predictions ruled out ibility of 50 mc/s working. By g the harmonics of commercial they were able to predict band

d the equinoctial period contacts o made in the late afternoon and enings over 5000 to 7000 miles. e of propagation is not clearly od.

Major Collett, VK2RU, of Gos- o established communication on Previously, brief contacts had de with Japan on the band. As fanuary of this year Bob Green- 'K4NG, QSO'ed JA. Major was VK to record openings over long and contacted 17 JA's in two

isly working had apparently been la Sporadic E multihop propa- vhile this latter opening would o be due to F2 layer reflections.

an ardent VHF experimenter, n following the MUF by obser- ver many years and noted the increase as the 28 mc band open- in March. With Easter approach- s decided to spend some addition- checking the MUF and the 50 nd.

ood Friday, Major was unfor- called out and Saturday was ed by a wedding, but carriers c/s were observed around 2 pm. r. April 1, was set aside for opera- 2.20 pm the band cracked wide JA with S9 telephony signals from 50 to 51 mc/s.

was the first station con- ut it was nearly half an hour ne QSO was complete, due main- the stack of JA stations on frequency. Major was rare DX a regular 14 mc/s "dog pile" on ds.

en this interference and Japan- ese phonetics he was forced to move down the band and there contacted JA3EK. By this stage the JA's were keeping away from Major's frequency and in just over an hour he had listed contacts with JA1ANO, 1GP, 1ID, 2JJ, 1AQ, 2QR, 4GJ

The conditions again were repeated on the Monday, the band providing signals from Japan. On Tuesday the line noise was too high at Major's QTH for operation. The JA tally for two days was 17 contacts for 14 different stations.

On Tuesday, JA's were heard in Sydney by both John Miller, VK2ANF, and Adrian Rofe, VK2HE. The former also heard an American Mobile Service on 48 mc/s the signals arriving from the North East. A close check on the MUF is being kept by a number of stations.

### EXTENSIVELY USED

Japanese operation on 50 mc/s is apparently very extensive and only a small number of the stations breaking through were contacted. One JA ran out of breath calling VK2RU and his wife took over the microphone.

Within a week 9 QSL cards had arrived confirming contacts and gave an indication of the extensive equipment in use on the band. He was asked to give full publicity to the number of stations anxious to work out of the country on 50 mc/s.

All stations use VFO control and J3ME's gear gives an indication of the specially constructed equipment. He runs an 829B final modulated by 807's, and the receiver 18 tubes with crystal controlled oscillator, the antenna 4 elements, 45ft high.

JA1AG running an 832 final into a 4 over 4 element beam also 45ft high. All stations have special 50 mc/s equipment and a number operate exclusively on this band.

Major expects that the 50 mc band should open fairly regularly to Japan and many contacts made in view of the reported operation in that country. The MUF was up to 45 mc/s within a week of the opening and it appears there should be some effective long listance TVI if ever the band is used for Television.

### VHF IN W.A.

The most interesting activity in the VHF field in WA has been extensive working on the 288 mc/s band.

Firstly Murray, VK6ZAM, and Wally, VK6ZAA went portable to North Dandalup to establish a new WA record of 44 miles by contacting Rollo, VK6BO, and Don, VK6ZAV. Following this Rolo has carried out checks with Don VK6DW in Bruce Rock over a 127 mile path.

Signals over this path have been heard consistently varying from S2 to S7 day by day.

Eight miles from Rollo's QTH is the Darling Scarp which rises to 1000ft, so the path is a difficult one Telephony has been copied on peaks, and Don VK6ZAW has also been heard by VK6DW; the latter has no transmitter as yet so no Australian record can be claimed.

The equipment in use is as follows:-

VK6BO — 832 Tripler driving a QQE06/40 to 40 watts input on 288 mc/s.

Antenna — 4 over 4 stacked Yagi, horizontally polarised with a full wavelength between bays.

VK6ZAV — 832 Tripler driving an 832 to 20 watts input on 288 mc/s.

Antenna — 4 over 4 stacked Yagi.

VK6DW — 4 over 4 over 4 over 4 beam, being a 4 over 4 a half wave apart one wavelength above a similar pair. The crystal controlled converter is a 6J6 P.P. neutralised Triode amplifier into a 6J6 push-pull mixer with an IF of 7 mc/s.

Having regard to the distances being worked overseas by amateurs on 420

**(Continued on Page 107)**

## INCREASING ACTIVITY ON 21 MC.

The 21 mc/s band is beginning to give a true indication of what can be expected in the way of DX stations in the next few years.

Currently it is rather erratic; openings to various countries close within a matter of minutes. DX stations will fade out, VK6's appear and at times in less than one quarter of an hour the VK6's will be out and DX stations again audible.

One pleasing feature is that if rare DX does appear the rush of W stations common on the 14 mc/s band is absent.

If you hear DX stations there is every chance of contacting them.

Before sunset and after sunrise are the best operating periods for unusual countries and all continents are likely to appear within an hour. Openings to Europe in the evenings on 28 mc/s are often better than those on 21 mc/s but the latter band generally provides signals over a longer period. The long path to Europe at this period on 21 mc/s is sometimes excellent.

It is difficult to estimate, even after days of listening, what prefixes will appear at any given stage.

Conditions vary day by day and on occasions the band is dead. Other areas are experiencing better conditions. VR2CG reports the band is open 24 hours for DX working.

American stations can be contacted throughout most of the day, Africans around sunset and Europeans and South Americans in the evenings. The latter three continents appear again in the mornings after sunrise. Asians run at S9 24 hours a day.

Even 10 and 15 watt DX stations peak at S8 at times.

CW activity is on the increase — it appeared that 21 mc/s would follow a similar pattern to 28 mc/s essentially a telephony band. In recent weeks, however, many new CW stations are operating. Some quite rare prefixes can be heard on CW including VU5, ZD6, ZD9, 9S4, Trieste, EA6 and EA9 and on telephony there is no limit of DX active.

The KN, WN, &c., Novice Stations are making excellent use of the band some with Quad and multi-element beams. A number are no longer Novices judging from their 20 WPM CW.

One problem common to all bands these days is commercial interference.

It is extremely heavy in the first 50 Kc/s mainly automatic morse stations rendering that section inoperable. 21 mc/s is an exclusive amateur band throughout the world, not that it means much these days.

The band will undoubtedly become extremely popular in the next few years and current 14 mc/s band supporters will retire there for some quiet operating.

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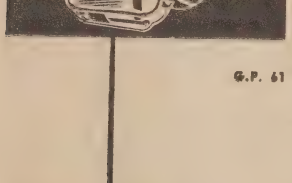
**G.P. 60** Incorporating G.P. 61 Ceramic Cartridge. The Pick-up for tropical conditions, unaffected by heat or humidity. **PRICE, £6/16/-**

**G.P. 50** Incorporating G.P. 59 Cartridge. A high gain Crystal Pick-up suitable for reproducing either standard or micro-groove records through low-gain amplifiers. **PRICE, £4/19/6**



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**SALIENT FEATURES:**

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- Low Stylus Pressure
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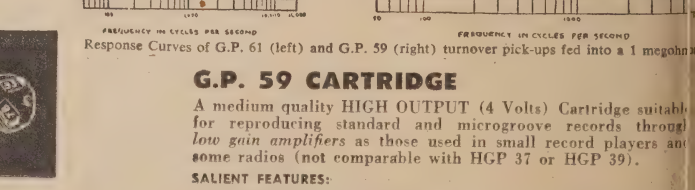
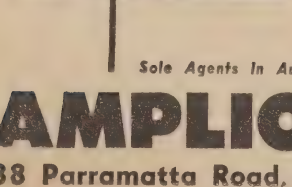
Tracking weight, 10/12 gms. **PRICE, £3/19/6**




Response Curves of G.P. 61 (left) and G.P. 59 (right) turnover pick-ups fed into a 1 megohm

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success of the 288 mc/s tests
irely surprising.
, it is a notable step forward
lian activity as the present
record for this band of 106
made with modulated oscillator
-regenerative receiver over a
path from elevated points.

he above notes were com-
ys was received that Rollo
8 mc/s transmission had been
Don VK6DW over a 186 mile
gnals were weak and fading

k his converter and beam to
up for the tests. Congratula-
Rollo and Don for their work
mc/s.

umn Field Day of NSW VHF
t in March was well supported
ne usual wet weather. 46
re active on 144 mc/s either in
r from their home QTH.

in the field out from Sydney
/K2AZO at Kangaloon, VK2HE
VK2HO Newnes Junction,
Waterfall, VK2HL out from
VK2ZAU Mt. Hunter, and
Wentworth Falls.

stations active in the coun-
VK2RS 12 miles from Albury,
Mt. Canobolas Orange, and
Kendall.

ountry stations active included
Forbes, VK2ALU Cowra,
umut and VK2AJO Coolamon.
stle and the Hunter Valley
VK2VU, VK2ADS and VK2BZ
ontacts with those areas.

test distance covered during the
s 204 miles for a contact be-
o Stitt, VK2WH, at Forbes and
erecht, VK2RS/portable near
The next longest contact was
Roy Hart. VK2HO/portable in
Mountains and Keith Dodd,
ortable out from Tumut —

er of contacts in the region of
) miles were made and some
SO-ed up to 36 different stations
in the event.

tent exchange of signals of a
of 200 miles on 144 mc/s is now
le between Hugo Stitt VK2WH
d Dave Davies VK2BZ New-
The VHF group are gradually
ll areas of the State.

## N FIELD DAY

of the autumn field day are as

stations: 1st, Roy Hart,
35 contacts, 304 points, 2nd,
ofe, VK2HE. 26 contacts, 208
3rd, John Miller, VK2ANF, 32
205 points.

Home Stations: 1st, Hugo
2WH, 181 points. 2nd, Peter
/K2JX, 139 points. 3rd, Lyell
/K2ALU, 109 points.

ecorded include special bonus
ee longest contacts.

ise scramble on 144 mc/s was
in March after the usual
HF Broadcast.

six stations participated and
rs were Bob Winch, VK2OA,
Miller, VK2ANF, who both
21 of the stations competing.

ril meeting of the NSW VHF
the NSW Division was devoted
monstration of Walkie-Talkie

nes, VK2AUI, displayed and
a commercially constructed
ting on 80 mc/s.

. VK2VL, Perc Healy, VK2APQ,
Miller, VK2ANF, all produced
e built 144 mc/s units. Those
knew quite a deal on circuit
the problems in building this
at the end of the four lec-

annual convention of the North
Tablelands Zone was held at
ver the Easter weekend.
sentative gathering of amateurs
rstate and NSW districts at-
All were extremely pleased to
riginator of these conventions
allick, VK2XO, present and it
he will take an active part in
unga events.

ults of the various field events
ollows:—

Challender Remembrance Con-
Noel Hansen, VK2AHH, 71
2nd, Don Pollard, VK2ASW, 57
3rd, Don McKenzie, VK2ALQ,
s.

Scramble for the United Radio
rs Trophy and open order: 1st,
Noel Hansen, VK2AHH, 2nd, Bill Hall, VK2XT, 3rd, Tie between Jack Hill, VK2ADT, and Don Pollard VK2ASW.

144 mc/s Hidden Transmitter Search: 1st, Noel Hansen, VK2AHH, 2nd Associates Fred Reid, Dorrigo, and Brian Slarke, of Bellingen.

As will be seen from the above results zone officer Noel VK2AHH won all field events and just to complete the weekend won the gentleman's lucky number trophy — he returned it however, in the interests of goodwill!

Several fancied competitors in the field events experienced equipment breakdowns, Harold Whyte VK2AHA with tube and Bill Hall VK2XT with "donk" problems.

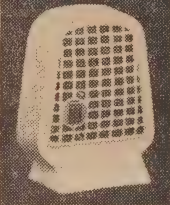
## BY WAY OF CHANGE

The event provided plenty of diversions from normal amateur radio activity. State President Jim Corbin VK2YC was in attendance and the organising committee comprised Patron Crieff Retallick VK2XO, Secretary Allan Williams, VK2FH, President and Zone Officer Noel Hansen, VK2AHH, Treasurer Ted Gabriel, VKB2AVG, Registration Officer Rod Pike, VK2ACU and Organiser Peter Alexander, VK2PA.

The Associate Members' Representative on the Council of the SA Division of the WIA, James Paris, has supplied details of a newly formed Short-Wave Listeners Group of the WIA in South Australia.

Readers in that State are reminded that the group meets on the third Monday of each month at the Central Methodist Mission, Franklin St., Adelaide, commencing at 8 pm.


AWA RONETTE
MICROPHONES & ACCESSORIES



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Hand or desk mounting, counter balanced base ivory plastic housing.

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ENGINEERS' REFERENCE BOOK

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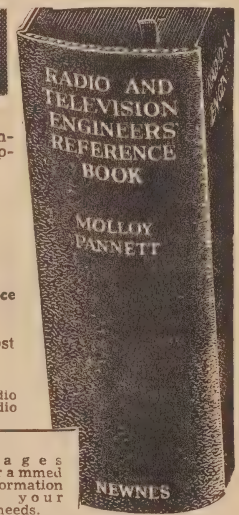
a brand-new work for those engaged in the installation and servicing of Radio and T.V. equipment, and in design and manufacture.

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# NEW SPEAKERS BY LEADING MANUFACTURE

**(6/9H) 6in x 9in OVAL PER MAG WITH 5T TRANS £1/15/-**

**(5C) 5in Standard-per-mag.—20/-**
**(5F) 5in Heavy Duty per-mag.—24/-**

Available with 10T or 7T Transformer.

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INTERSTATE 5

## ALL GOODS ADVERTISED ON THIS PAGE ARE N

### EXTENSION-SPEAKERS

New Rola 6in x 9in Ovaltone extension speaker. Mounted in durable and attractive plastic-covered cabinet.

**£3/10/-**

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12mfd 525V .. .. .. .. **3/9**
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### 12-inch P.M. Speakers

Heavy duty 12in per-mag speaker by well-known manufacturer. 10T, CT, or 5,000 Transformer. .. .. **£2/7/6**

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These New Vernier Dials are ideal for test equipment, receivers, etc.
(as used on AR8 sets)

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### DYNAMIC SPEAKERS

7in Dynamic speakers by leading manufacturer,
1,500 ohm Field Coil,
7,000 ohm Transformer
or
Ovaltone Dynamic Speaker
9in x 6in. 1,000 ohm
Field 5,000 or 7,000 ohm
Transformer.

**25/- EACH**

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### TELEPHONE GENERATORS

New small telephone generators, ideal for bell ringing, etc.

**12/6** Postage extra

### CARBON RESISTORS

Color Code Card Supplied

Well-known make of carbon resistors in values of 100 ohms to 5 megohm. In 1-watt, ½-watt and 1/3-watt. All resistors are standard color-coded and in original cartons. In lots of 100 mixed values comprising 50 1-watt, 25 ½-watt, 25 1/3-watt.
Price—Box of 100 .. .. .. **8/6**

Postage 1/6.

### SHOCK MOUNTS. NEW

Protect your equipment with these mounts. Set of 4 mounts and rack. 11in x 8in — 3/6.

Plus postage

### NEW INDICATOR UNITS

For that C.R.O. 10 valve 7.EF50 1.879 1.EB34 1.5BP

**£8/10/-**

Plus postage

### I.F. TRANSFORMERS

Standard I.F. transformers, square can (1⅜) 455K.C., permatuned. **3/9each.**

(Plus Postage)

### CONDENSER SPECIAL

Boxes of 100 new mica and paper condensers in values ranging from 50pf. mica to .5 400v paper. Values include .0001, .00025, .00075, .01, .02, .05, .1, etc,

**30/-** PER 100

### NEW NATIONAL POWER TRANSFORMERS

**UPRIGHT MOUNTING**

240v Pri. Sec.
285 x 285 at 60ma
6.3 at 3 amp. 5v 2 amp.

**26/6**

Postage N.S.W., 3/6—Interstate 4/9.

### I.R.C. RESISTOR

100 I.R.C. carbon resistors, ½, 1 & in values 50 ohm to 5 meg. i many popular sizes, 3T, 15T, 20 50T, 100T, 250T, 500T, etc.
(Standard resistor color code su Box of 100. **1**

(Plus 1/6 postage.)

### NEW VIBRATORS

6 volt A.W.A. gas-filled rators. Heavy duty synchr

**NOW 7/6 or 70/- per**

### HOOK-UP WIRE

(10-.010)

Plastic covered—6/9 per 1
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Rubber and Glazed Cotton Push
10/- per 100ft.
Postage 2/- extra

### SPEAKER TRANS

New Rola Speaker transformers. 3 V.C. 5,000.

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### SAPPHIRE NEEDL

Rothermel sapphire ne play 2000 recordings. in England. Each 2/9 or dozen.

### POTENTIOMETERS

Standard ½ or 1 meg. sw pots long spindle d/p sw

**6/6**

½ meg. or 25T. ohms s spindle switch pots .. ..
½ meg. or 100T. standard p long spindle .. .. .. ..
½ meg. or 100T. short spir

**1/9**

All plus postage

*Please address all correspondence to 479 Parramatta Road, Leichhardt, N.S.W.*

# METROPOLITAN RADIO SUPPLIES

**640 KING STREET, ST. PETERS, N.S.W.**
**PHONE LA6087.**

**479 PARRAMATTA ROAD,**
**LEICHHARDT, N.S.W., PHONE LM**

# lew Record Changers at Bargain Prices

**Stromberg-Carlson 3-speed Changer el 104 with High Fidelity turn-over al pickup. £14/15/-** F.O.R

**New English Garrard 3-speed Changers with High-Fidelity crystal turn-over pickup. £14/15/-** F.O.R

## NEW AMERICAN INDICATOR-UNIT

**These indicator units contain the following valves:**

Six 6SN7GT, one 6G6, one 6H6, one 6X5GT, one 2X2 and 3BP1 C.R.O. tube which is fitted in a separate shield on a 4ft shielded lead and supplied with control box and plug; case and shield are finished in black brocade. In original cartons.

TRANSFORMER TO CONVERT THIS UNIT FOR 240 VOLT OPERATION AVAILABLE AT £3/10/- EXTRA plus postage.

£8/15/- F.O.R.

## .MERICAN RELAYS

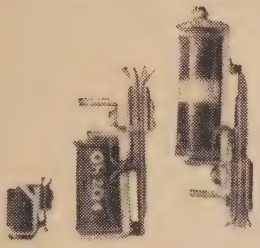
Miniature relay 300 oil. S.P.D.T: contacts, .. .. .. 7/6

Standard relay 250 ohm coil 4 pole S.T. .. .. .. .. .. 7/6

S.T .. 6/6

Standard relay 15,000 oil, 2 pole D.T.. 12/6

relays suitable for rewinding.



## C. AMP METERS

Amp. Meters (ex-County oil) A necessity in any ricity workshop.

GE: 0-5 amps. (can be ex d by shunts). **28/6**

METER: 7½ inches

Postage extra—NSW 6/6, Interstate 11/6.

## Tuning-Unit

H.F. tuning units are suitable for the band contain three tuned coils, 7 plate c trimming conden- three acorn sockets dic) and 3 new 954 valves.

**25/-**

PLUS POSTAGE

## A.T.5 TRANSMITTERS

Transmitters supplied complete with valves (3-807 and .. .. .. .. .. .. .. .. .. .. .. .. **£4/17/6** F.O.R

## FULLAPHONES

Containing pair of headphones morse key, buzzer key, switches, etc. **20/-**

Post NSW 6/6 Interstate 8/6

6SH7 VALVES—TESTED 3/-

## B.S.R. MOTORS

These English B.S.R Motors as used on most tape decks also have many other uses Size of motor 3" x 2½" x 2¼" deep with 3/16" shatt, for 240 or 110 volt AC operation.

**39/6** Postage N.S.W., 3/, Interstate 4/6

## PLUGS AND SOCKETS

New 26-pin shielded plugs and sockets with silver-plated contacts.

5/- pair, plus postage

5-pin shielded plugs and sockets **2/9**

## LINE FILTERS

Cut out that electrical interference with these line filters.

For use on AC or DC equipment, 12 volt to 110 volts .. .. .. .. .. .. .. .. .. **10/6**

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**479 PARRAMATTA ROAD, LEICHHARDT, NSW. PHONE LM3610**

# NEW AMERICAN TELEPHONE WIRE CLEARANCE

**Rubber-insulated with stainless steel and copper conductors supplied on metal reels each containing half a mile of wire.**

**½-mile reels NOW 15/-** Post Extra | **In case lots—6 reels (3 miles) NOW £**

## RADIO ALTMETERS, TRANSMITTER RECEIVER TYPE RT-3A/ARNI.

Complete with the following valves:—5-12 H7, 2-12H6, 2-12SJ7, 2-995, 2-9004 and one VR150. Midget 28V. Genemotor .. .. .. .. .. .. .. .. .. .. .. **£4/17/6** f.o.r.

NEW—RT34 APS13

## TAIL END CHARLIE

21 Valve, 420 Meg. Transmitter Receiver Gene Powered

5-6J6, 9-6AG5, 1VR150, 2-2D2

**£10**

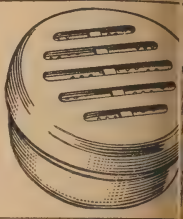
Less Valves, £6/17/6

## PILLO-FONE

**EXTENSION-UNIT**

IT'S A REAL MINIATURE WITH ROLA UNIT

Install it anywhere, in the sick-room, workshop, garage or any room in the house. Just connect across voice coil of the existing speaker. The "PILLO-FONE" IS THE MOST CONVENIENT LITTLE UNIT YET DEVISED. 3½in Diameter by 1¾in deep. POST FREE **22/6**



# NEW — C.R.O. TUBES

VCR 138 42/6

VCR 97 47/6

32J-CV958 37/6

3AP1 (CERAMIC SOCKET SUPPLIED) 58/6

## RELAY-TYPE COUNTERS

("Mercury" American Made) These relay counters register from 0 to 99,999. Can be supplied with 250ohm, or 5,000ohm coils.

25/-
Plus Postage

## P.M.G. TYPE RELAY-COUNTER

0—9,999.

1,300 ohm coil .. .. .. .. .. 15/-

## NEW 3 INCH C.R.O. TUBES TYPE 3.API

SOCKET SUPPLIED

**£2/18/6**

POST EXTRA

## NEW POWER TRANS. FOR ABOVE £3/10/-

POST EXTRA

## 24-VOLT MIDGET MOTORS SHUNT WOUND

Fully Lam ated Fie Wound Ar ture. Sixt Segment C mutator, t bearing Ar ture. Ideal Model Trains, Hobbyists, etc. Condi New.

Price, each .. .... .. .. .32

Packing and postage: NSW 1/6; In state 2/6.

Transformer and metal rectifier to operate either of above. From 240V AC 30/-. Plus postage.

## NEW FLEXIBLE DRIVES

Flexible drives to suit command transmitters or receivers 5ft 6i long .. .. .. .. .. .. .. .. .. .. .. 10/- Plus postage

To suit compass receivers 2ft long .. .. .. 10/6 Plus postag

# NEW 5 VALVE D.W. MANTEL VIBRATOR CHASSIS

These Mantel Vibrator Chassis made by leading manufacturer have R.F. Stage and are supplied complete with Rola 9in x 6in oval speaker, valves and vibrator supply for 6 volt operation. Give good results on local, interstate and overseas stations with excellent one.

CHASSIS ARE NEW BUT SHOPSOILED. Ideal for building into caravans, boats, etc. Size of chassis, including dial, speaker and vibrator supply. 14in long x 10in deep x 14in high.

LIST PRICE OVER £40/-/-

**SPECIAL PRICE £16/17/6** F.O.R.

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640 KING STREET, ST. PETERS, N.S.W.
PHONE LA6087

479 PARRAMATTA ROAD, LEICHHARDT, N.S.W.
PHONE LM3610

# NEW VALVES

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5 | 9/6 | EK32 | 15/- | 6F6 | 9/6 | VR150 | 15/- |
| 6 | 9/6 | 6J8 | 15/- | 807 | 12/6 | VR65A | 2/6 |
| 4 | 9/6 | 6K7 | 7/6 | EL32 | 9/6 | EBC33 | 9/6 |
| 5 | 15/- | KTW62/6U7 | 7/6 | 12A6 | 12/6 | AV11 | 5/- |
| 5 | 15/- | EF8 | 9/6 | 6J7 | 8/6 | EZ82 | 9/6 |
| 4 | 15/- | 7C7 | 3/6 | 6SL7 | 10/6 | 117N7 | 15/- |
| 4 | 15/- | 7A6 | 3/6 | 6SN7 | 10/6 | 100TH | 45/- |
| 5 | 2/6 | 78 | 7/6 | 954 | 5/6 | 4307A | 10/- |
| 5 | 9/6 | 6J6 | 12/6 | 955 | 5/6 | 5Y3GT | 12/6 |
| 7 | 9/6 | 6AG5 | 10/6 | 9001 | 5/6 | 12SR7 | 3/6 |

ALL VALVE PRICES PLUS POSTAGE

## NEW SWITCHES

| | |
|---|---|
| axley 3 x 3 SB | 3/3 |
| ak 3 x 3 2B | 4/6 |
| lpha DP/DT | 3/3 |
| ak 1 x 2 SB | 1/9 |
| ak 1 x 3 SB | 2/- |

Post extra.

## NEW VALVE SOCKETS

| | |
|---|---|
| or large 7 pin amphenol ceramic ith mounting | 2/9 |
| pin teletron moulded per doz. | |
| akelite | 5/6 |
| pin loctal moulded per doz. | 6/6 |
| pin wafer per doz | 3/6 |
| pin innoval wafer per doz | 10/- |
| pin miniature per doz. | 10/- |

Post extra.

## GENERATORS

2 volt 500 watt, tested in good rder £3/10/- F.O.R.

## BUZZERS

uzzer, variable note, works off volt battery 7/6

## SELSYN-MOTORS

lew American selsyn motors 50 olt transmitter or slave. Small, 2/17/6. Slave only £1/17/6.

## OIL FILLED PAPER CONDENSERS

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| 5mfd. 600v. | 10/- |
| mfd. tapped at 5mfd. 110v. AC | 7/6 |
| mfd. 400 v. | 2/9 |
| 01mfd. 500v. | 7/6 |
| 1 x .1 400v. | 2/6 |

Post extra.

## SUPPRESSOR CONDENSERS

.25mfd. 240v. AC working 2/6
.01 x .02mfd. 240v. AC working 2/9

Post extra.

## MIDGET CONDENSERS

Five plate midget condenser, ceramic insulation, standard single hole mounting ¼in spindle 0-30pf. 4/6

## METAL RECTIFIERS

90 volt 200m.a. metal rectifier, suitable for operating relays, etc 5/6

## THROAT MICROPHONES

New American throat mikes, per pair 3/6

## SIG. LAMP GLOBES

Lucas signalling lamp globes 10v. 6/- per doz.

PRE-FOCUS GLOBES

12v. 420 watt. 7/6

Post extra.

## CREED-'RELAYS

New creed relays supplied with mounting base. £3/10/-.

## MICROPHONE TRANSFORMERS

Carbon microphone transformers, new, 4/6.
Post extra.

## BUTTERFLY CONDENSERS

60pf. x 60pf. butterfly condensers 8/6.
Post extra.

## TUNING CONDENSERS

Two gang "H" tuning condensers 10/6.
Three gang 15/-.
Post extra.

## I.R.C. WIRE-WOUND RESISTORS

5,000 ohm. 5 watt 5% 1/6 ea. or 10/- per doz.

4,800 ohm. 5 watt 5% 1/6 ea. or 10/- per doz.

200 ohm. 20 watt 10% 2/3 ea. or 15/- per doz.

5,000 ohm. 20 watt 5% 2/6 ea. or 20/- per doz.

750 ohm. 30 watt 5% 2/6 ea. or 20/- per doz.

## PRECISION RESISTORS

I.R.C. precision wire wound resistors 1%. Available in the following values:—20k, 30k, 50k, .15m, .2m, .25m, .5m and 1m.

10/- each.

## NEW METERS

10m.a. 2½in flush mounting meters, American, 15/-.
English Tuner 3in flush mounting meters, 10m.a. 20/-.
English 0-600v. with shunt flush mounting, 20/-.
Post extra.


# METROPOLITAN RADIO SUPPLIES

640 KING STREET, ST. PETERS
N.S.W.
PHONE LA6087

479 PARRAMATTA ROAD,
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PHONE LM3610

# MOTOR SPARES LTD

## RESISTORS

**½ Watt Carbon.** All brand new and in good condition. Sizes listed in ohms. 50, 170, 250, 300, 320, 350, 450, 500, 600, 750, 800, 850, 880, 900, 990, 1000, 1200, 1300, 1500, 1700, 1800, 1900, 2000, 2200, 3000, 3200, 3500, 4300, 6500, 7500, 7900, 8000, 10,000, 13,000, 15,000, 25,000, 37,000, 40,000, 50,000, 60,000, 80,000, 90,000, 100,000, 150,000, 160,000, 250,000, 300,000, 400,000, 500,000.

**Price 3d ea. 2/3 doz. 16/- per 100.**

**1 Watt Carbon.** All brand new and in good condition. Sizes listed in ohms. 250, 350, 400, 450, 500, 600, 800, 850, 1500, 2000, 3000, 4000, 4700, 5000, 6000, 10,000, 12,000, 15,000, 25,000, 40,000, 50,000, 70,000, 75,000, 100,000, 150,000, 300,000, 350,000, 500,000, 1.75 meg, 3 meg, 5 meg.

**Price only 4d each, 3/- doz. £1 per 100.**

**2 Watt Carbon Resistors.** Sizes in ohms 100, 200, 800, 6000, 10,000, 80,000, 3 meg. **Price 6d each.**

**5 Watt Wire Wound.** All brand new and in good condition. Sizes listed in ohms. 100, 125, 200, 300, 350, 400, 450, 550, 600, 650, 700, 750, 800, 1000, 1200, 1500, 2000, 2500, 3000, 3500, 4000, 4500, 5000, 6000, 7000, 9000, 10,000. **Price only 9d each or 7/6 doz.**

**8 Watt Wire Wound.** 150, 200, 300, 350, 400, 450, 500, 550, 600, 700, 750, 5000. **Price 10d each or 9/- doz.**

**10 Watt Wire Wound.** 1500, 1750, 2500. **Price 1/- each or 10/- doz.**

**12 Watt Wire Wound.** 1000, 2000. **1/- each or 10/- doz.**

**20 Watt Wire Wound.** Sizes in ohms. 50, 75, 125, 150, 175, 200, 250, 300, 400, 500, 750, 1250, 1750, 5000 with variable tap, 7000, 15,000, 50,000. **2/- each, 21/- doz.**

**25 Watt Wire Wound.** Sizes in ohms. 50, 75, 100, 125, 175, 200, 250, 300, 400, 750, 1250, 1500, 1750, 3000, 7500. **2/6 each, 27/- doz.**

**30 Watt 1% Resistors.** Suitable for standard for resistance bridge, etc.. 1000 ohm, 2000 ohm. **4/6 each.**

**50 Watt Wire Wound.** Sizes in ohms. 20 with variable tap, 50 with variable tap, 250, 2500, 100,000. **4/- each.**

**The following resistors have been made exclusively for the British Navy or Australian Army, etc.,**

| Resistance in ohms | Tapping | Power Watts | Price |
|---|---|---|---|
| 19 | C.T. | 100 | 5/- ea |
| 23 | — | .8 amps | 4/- ea. |
| 36 | — | 100 | 5/- ea. |
| 45 | — | 100 | 5/- ea. |
| 50 | — | 20 | 2/- ea |
| 50 | — | 10 | 1/6 ea. |
| 60 | C.T. | 60 | 4/- ea. |
| 100 | — | 100 | 5/- ea. |
| 120 | — | 80 | 5/- ea. |
| 150 | — | 20 | 2/- ea. |
| 200 | — | 100 | 5/- ea. |
| 250 | Variable | 25 | 2/6 ea. |
| 500 | — | 27 | 2/6 ea. |
| 500 | — | 100 | 5/- ea |
| 700 | — | 20 | 2/- ea |
| 850 | — | 20 | 2/- ea |
| 1000 | C.T. | 150 | 5/- ea. |
| 2000 | — | 150 | 5/- ea. |
| 5000 | — | 20 | 2/- ea |
| 5000 | — | 40 | 3/- ea. |
| 5500 | — | 12 | 1/6 ea. |
| 10000 | Tapped 3000 | 55 | 4/- ea. |
| 25000 | — | 30 | 3/- ea |
| 25000 | — | 40 | 3/- ea. |
| 25000 | — | 75 | 5/- ea. |
| 5000 | — | 80 | 5/- ea |

1. **Carbon Mike Inserts,** single button type. Suitable for telephones, home broadcasting, etc. **2/9 each.**
2. **Transformers.** Suitable for connecting above microphone to radio set, etc. **4/6 each.**
3. **Ferroxcube Rod Aerials,** ideal for Portables, takes the place of a loop aerial, performance equal to 60ft outdoor aerial. **Price only 16/6 each.**
4. **Genemotors type PE94A.** Input 28 volts, output 300 volts DC at 260 mA, 150 volts at 10 mA, 14V DC at 5 amps. Enclosed in a metal case with cooling fan, carbon pile regulator and efficient filter. Could be converted to 32 volt motor. **Price only 25/-.**
5. 3 Speed Motors made in U.S.A. to operate off 230 volts AC. Speed control lever and indicator plate provided. Suitable for playing standard and microgroove recordings **Price only £5/10/- ea.**
6. 3 Speed Record Changers made in England, well known make. These are new and guaranteed in good order, few only available. **£13/10/- each.**
7. **Throat Microphones** in new condition. **Price 3/6 each.**
8. **Microphone Adaptors** designed to adapt the throat mike to the amplifier input, new condition. **Price 5/- ea.**
9. **Cord assembly** to adapt throat mike to adaptor, has the necessary plugs, etc. **Price 2/6 ea.**
10. CD 508A. Cord Assembly with phone plug, 2 pin socket and press-to-talk switch. **Price 2/6 ea.**
11. **Phone Jacks.** 2 single circuit jacks mounted on one bakelite panel. **Price 2/9 ea.**
12. **Phone Jacks.** Closed circuit Jack, mounted on black bakelite. **Price 2/6 ea.**
13. **1 mA Dry Metal Rectifiers,** full wave suitable for meter rectifier. **Price 15/- ea.**
14. **80 mA filter chokes,** 30 Henry, 500 ohms DC resistance. Worth 49/6. **Our price 13/6.**
15. **75 mA filter chokes,** 50 Henry, 450 ohms DC resistance. Worth 25/-. **Our price 12/6.**
16. **Indicator lamps** made of black bakelite with red or clear glass, ideal for instruments, tail lights, side lights, etc, on motor vehicles. Screw in torch globe fits into these lamps. **Price only 1/6 ea.**
17. **Battery Chargers,** will charge 6 or 12 volt battery at 2½ amps, complete with fuse and guaranteed. an excellent job worth £10/10/- **Our price £7/10/-.**
18. **Resistor Banks** consisting of 36, ½ meg, 1 Watt IRC condensers mounted on 2 polystyrene strips. **Price only 3/9 ea.**
19. **Meters.** 0-100 volts AC. This is a 1 mA DC resistor, with inbuilt series resistor and dry metal rectifier, square face 2 inch scale. Well worth £4/10/-. **Price only 32/6 ea.**
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# MODULATOR & POWER SUPPLY

(Continued from Page 67)

ble current flowing, i.e., ads, screen droppers and bias resistors.

verall frequency response of ulator would not make a ility audio fan rub his hands but it is ideal where the is to get a readable and ly sounding signal through ifficult conditions.

e low end the response is 3 db down at 200 cps and 100 cps while at the high -3 db point occurs at about and at 6000 cps the level is db down.

ng the frequency response one step in the process of g the modulation more . It is almost impossible to a constant speaking level lking into a microphone and control can be advanced without overmodulating if a compressing amplifier is in- The principles are similar AVC system in an ordinary

further improvement can be y installing a peak clipping to remove the sharp peaks cause overmodulation (and t you into trouble with the spector) without contribut- h to intelligence.

lipper is followed by a low ter to remove most of the n components and in a well- l system the average level increased by 10 db or so noticeably detracting from ralness of the speech.

ideas are all very nice but add enormously to the com- of the transmitter and the y in getting it to operate cor- Information on the subject in the standard amateur cs and those particularly in- will find a study of the chapters fruitful.

me time in the future we may to undertake the develop- similar techniques particul- ted to local components and ns. In the meantime the tter in its simplest form has te appeal to the new Ham just beginning to feel his well as many of the older o cannot spare the time to t an elaborate transmitter.

the present we have had to say about the control The relays, switches &c. are d in the transmitter and the iate circuits closed via the nnecting cable.

details will be given in the g issue but a brief outline ystem is appropriate here.

cing with the circuit diagram, 2, you will see that by closing and 8 of the power outlet the lower of the two power will be brought into oper- he upper of the two supplies ilarly be brought into oper- n series with the lower by pins 4 and 5 with a separate contacts.

der to operate the VFO with- power amplifier for netting s the lower of the two sup- one can be used. However, if mply switched on by closing and 8 the wiring is such that high tension would be applied to the screens of the EL34's with no plate voltage and but little bias. The result would be that the dissipation ratings of the screens would be greatly exceeded

When, however, pins 1 and 3 are closed the total current of the supply flows through the 5000 ohm resistor. This adjusts the voltage applied to the VFO and at the same time applies a high negative bias to the grids of the EL34's.

## Airborne teleprinter

A NEW ground-to-air teleprinter communications system, which marks another "first" for British civil aviation, was used recently for the first time when a BOAC Stratocruiser crossed the Atlantic on a scheduled Monarch service from London to New York.

The object of the system is to receive essential flight information, including meteorological and navigational reports, transmitted by special ground stations in the UK and Canada, and to present it directly to the captain of the aircraft when in flight in the form of a typewritten sheet.

This development represents a remarkable example of co-operation. Many organisations were involved and less than 12 months have passed since the characteristics of the system were decided. In that time a special radio receiver has been designed and produced, a new light-weight printer has been made available, and ground transmitters have been assigned and modified for the purpose.

While BOAC took the initiative in this project, it was greatly assisted by the Ministry of Transport and Civil Aviation and Canadian authorities — who, between them provided the ground station transmitters — by Standard Telephones and Cables Ltd., who are supplying the airborne receiving system, and by Creed and Co. Ltd., who specially developed the teleprinter for airborne use. Meanwhile, Marconi's Wireless Telegraphs Co. Ltd., of Chelmsford, have also been active in the development of equipment.


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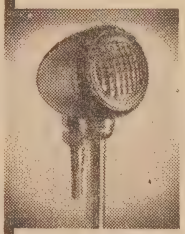

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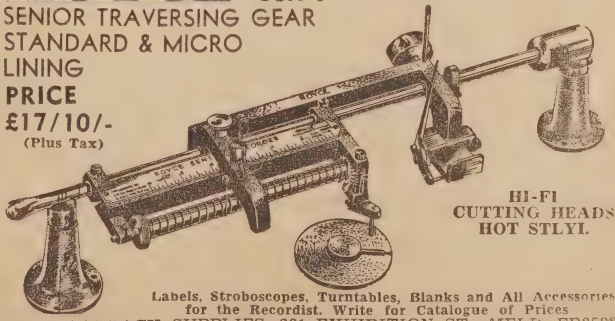

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# FIRST ALL-COLOR TV STATION

(Continued from page 9)

Two cameras are used simultaneously, one scanning a background scene, and the other scanning the inset object, which is placed against a black backdrop. An electronic mixing device automatically records a silhouette of the inset object (Alice for example, in the shrinking scene), then "cuts" a correspondingly shaped hole in the background and makes the insert.

The process requires precise control in production work as well as in electronic timing, which must be accurate to one ten-millionth of a second.

## SINGLE PICTURE

The effect of the inset, unlike that of a superimposed television image, is to present a solid picture without overlapping or transparency.

In this respect, the new system is similar to the matting process in film, which requires complex lighting and processing work. Thus the inset permits the instantaneous use of live camera effects which could be achieved formerly only with the use of processed film.

NBC engineers have pointed out that the color video inset broadens the whole scope of color television production. With its use, an actor may be placed against the background of a mountainside, a city street, or a seashore, brought into the studio "live" from any location that can be reached with a television camera.

Or, doing it the other way around, actors may be placed in spectacular settings which may be set up in miniature in the same studio, or even in another studio—the inset system reducing the apparent size of the actor to fit the background.

The color video inset is an extension and refinement of the black-and-white video inset. Both techniques were pioneered by the Development Group of the NBC Engineering Department, which interprets and adapts the laboratory research of RCA to the broadcasting uses of NBC.

# SQUARE WAVE

(Continued from Page 25)

Thus, if modern microgroove ords are cut on equipment co able to that described by Davi overshoot and ringing on tran should be of sufficiently low to make precautionary metho the amplifier worthwhile.

The latest "Playmaster" amp are extremely good in this re showing hardly a trace of r when tested at 1Kc. Even at the overshoot and ringing are noticeable.

The same would not be true, ever, of old-style feedback amp which generally lacked any pr tionary measures.

# FROM THE EDITOR—OVERSEAS

(Continued from Page 31)

new, six-storey building which has risen from the rubble which faced Cologne's cathedral.

In TV, West Germany has stations at Hamburg, Cologne, Berlin, Frankfurt, Stuttgart, Baden and Munich Hamburg has the most elaborate set-up with four studios—Cologne has only one so far, capable of handling plays and small broadcasts. There is a licence fee of £5 (plus basic radio fee of £2/2/-) and perhaps 400,000 sets in use.

I had contradictory figures on screen sizes, some greatly favoring the 21in (about £65), and others the 17in (about £45) with a fair sp ling of 24in (£85) and 27in offing. These prices must of be related to the generally lowe ing standard in Germany.

Station hookups are by wave links—no cables are use this purpose. A single evening gram is used through West Ger when there is one. Until there is generally a local pr for a couple of hours. Broa were experimental from 1950 but have been on a regular for the past four years. S used is standard 625 lines.


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(Continued from page 81)

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tector wiring isn't hard
l the smaller components
ted on two tagstrips in a
ition to the detector socket.
nd suppressor grid of the
alve are earthed.
ver end of the reaction
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coupling capacitor and a
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recaution, this point is also
for RF with a .1 mfd

## SUPPLY

een supply is also taken
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nfd capacitor.
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The loudspeaker should be
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and output valves can be
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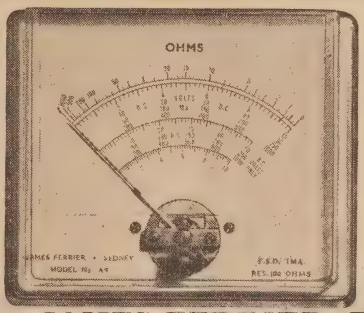
m the loudspeaker.
an aerial of about 20 feet to
id set the reaction capacitor
plates meshed about half-
ing across the dial should
ig in the local stations. If
ons are weak and cannot
rated, try advancing the
reaction capacitor until just below the point of oscillation. This will result in an appreciable increase in volume, and it will be easier to separate the stations.

If the set cannot be put into oscillation, even with the reaction capacitor fully meshed, try reversing the connections to the reaction winding. If this does not help, revert to the original connections and add some more turns to the reaction winding, until the set goes into oscillation with the capacitor meshed about half-way.

Similarly, if the reaction cannot be controlled, the number of turns should be reduced, or the winding spaced slightly further.

Unless some of the old components break down during the test, the receiver is then ready for service.

A little warning in closing: Once it has been established that the set is capable of oscillation, it should not be allowed to oscillate any more. Besides causing severe distortion in the loudspeaker, an oscillating set will radiate from its aerial and spoil the listening pleasure of others for miles around. Therefore advance the reaction capacitor only far enough for reasonable selectivity and good volume and no further.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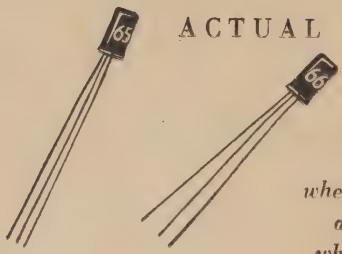


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# NSWERS TO CORRESPONDENTS

**edlands, WA)** writes to say is had complete success with inear amplifier (using EL37's) ed it slightly to incorporate pling between the EF86 and

ks for your letter. The modi- ou suggest is quite in order, 've decided against it in this case. Many amplifiers do use pling in this position.

**ivedock, NSW)** wishes to pur- chassis for the "Micro-amp" the December, 1955 issue and ell us that he has been unable

regret the inconvenience that aused in obtaining this chassis ie blueprint was a trifle late it to the chassis manufacturers ff holidays around that time. it should have been available stores at the time of writing. When ordering chassis for is a good idea to quote the on the circuit diagram rather itle of the article, since the anufacturers know our units at name. It has caused a little in obtaining chassis in the your reference to a "Simple cord Player" may account in ure for the difficulty you have d.

**bes, NSW)** submits some ques- answered in the Answer Tom ne magazine.

thanks for your letter, F.B. en duly passed over to our m writer for possible use in ssue. However, for more de- direct answers to your queries dio Amateur's Licence and the of same, we suggest that you et to the Wireless Branch of in Sydney or to the Honorary Wireless Institute of Australia, GPO, Sydney.

**Chatswood, NSW)** suggests that e some constructional articles ers or receivers in the maga-

e a number of such units have ribed in the past and we feel e present, these should suffice ng FM fans. The present list ers and receivers is as follows: tal FM Tuner — November, rimental FM Tuner & Foster- Seriminator — January, 1949; M Receiver — November, 1949, ner — February, 1950 and the FM Tuner — May, 1955. With tion of the May, 1955 issue, these R & H publications are available from this office. How- uit reprints, parts lists &c., ecured in the usual way through service.

**Perth, WA)** writes in appreciа- various articles on high qual- ers but points out that many annot afford such equipment have invested in a good speak- er items. He suggests that we article on how to modify the ommercial radiogram for high production.

thanks for your comments t we are glad you find the so interesting. We fully ap- e financial problems that beset our readers but we doubt he solution is to be found in ication of commercial equip- mittedly there is not always the high power and this was the ehind the Playmaster No. 13 n the January issue. But it is her thing to modify commercial up to this standard, particular- would be difficult to detail a which would suit all likely l designs.

**B (Ship address)** says that Cal- rs got things mixed up in his page 17 of the December 1955 vement in the Northern Hemi- clockwise.

y thanks for your letter. We our note on to Calvin Walters m take it from there.

**H.J. (Auburn, NSW)** makes some in quiries about the shelf life of electro- lytic capacitors and suggests that the makers stamp them to indicate their probable life.

A. In the first place we cannot quite agree that the shelf life of dry batteries is only eight weeks. The battery manu- facturers claim a shelf life of six months in the least favorable case; that of the miniature HT batteries. Larger bat- teries have a much longer shelf life and rare cases have been reported of tele- phone cells being in operation for 15 years. The electrolytic capacitor does not deteriorate in the same way and it is normally sufficient to reform the surface of the aluminium foil before putting into service. The makers recommend that this be done by apply- ing 90 pc of the rated voltage through a 10,000 ohm heavy duty dropping resistor. This will reduce the voltage applied to the capacitor while the leak- age is heavy and slow, increase it as the leakage is reduced. This treatment should be continued until the leakage current is reduced to normal for the particular type. We regret that we cannot help you in regard to your receiver due to the limited information you have been able to supply. We suggest it would be better to enlist the aid of a reliable serviceman.

**T.I. (Strathfield, NSW)** has built what appears to be a simple three-valve bat- tery set but which appears to be per- forming poorly. He points out that he has previously built a number of Radio and Hobbies circuits with complete suc- cess.

A. Your trouble would almost cer- ainly appear to be lack of regeneration causing poor selectivity and the con- sequent swamping by the powerful local stations. The absence of the customary whistle emphasises this. Most likely cause of your trouble is reversed feed- back winding, but you can also try modifying the screen circuit to apply slightly higher screen voltage to the 1T4. These circuits are often quite critical which is one reason they are not so popular nowadays. You would need only a few feet of aerial at your location.

**N.W.G. (Marrickville, NSW)** has con- structed the Baby Playmaster No. 4 with some minor modifications and is using it with an Acos GP20 pickup. He feels; however, that the high frequency end of the spectrum is accentuated excessively and also that the needle scratch is too prominent.

A. Without any special compensation the GP20 exhibits a peak in the 5 Kc to 6 Kc region of some 10 db above the 1000 cps reference. The subject was discussed at length in the November, 1952 issue and suggestions regarding suitable com- pensating circuits made. Unfortunately, the issue is no longer available from this office but you could see it at a public library. Better still they may be willing to make a photographic copy of the article for you. The filter circuit sug- gested results in a drop in the overall gain so that the reserve which you ap- parently have at present may be very useful. With an 80 mA power transformer the power supply should have a reserve of current for any tuner you are likely to use.

**V.W. (Coogee, NSW)** has purchased a dark room globe but is worried by the low light output from it. He requires a suitable light for the handling of bromide papers.

A. The type number you quote has no significance in the matter of color. The "B" indicates a bayonet cap and the "22" the diameter in millimetres. Thus it simply means a 22 mm bayonet cap. The dark red is intended for fast ortho films and is really unsuitable for bromide work. A better choice would be the light red or the yellow green but even these give less light than a properly designed safe light filter. A good choice is the Wratten OA used in conjunction with a 15 or 25 watt lamp in accordance with the maker's instructions.

**R.P. (Unbermille, NSW)** sends a cir- cuit and details of a simple telephone ha- has built from disposals parts and suggests that it may suit the Reader Built It page.

A. Many thanks, R.P., and we have filed your letter for possible use as you suggest. In the meantime we feel we must commend you on the manner in which you appear to have improvised various parts of the system from odd scraps.

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Queries not accompanied by the necessary fee will be answered FREE in the columns of the magazine and presented in such a way as to be of interest to other readers.

To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three con- structional projects. Scale blueprints showing the position of all holes and cut- outs in standard chassis can be supplied for 5/-. These are available for nearly all our designs but please note they do NOT show wiring details.

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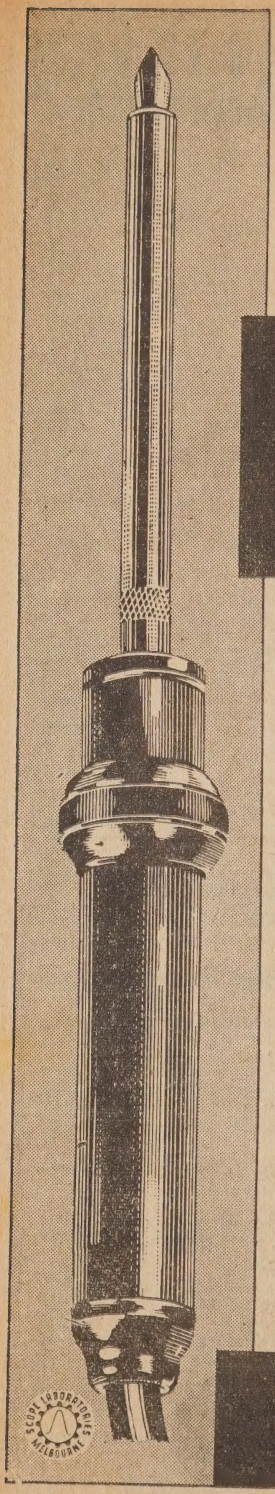

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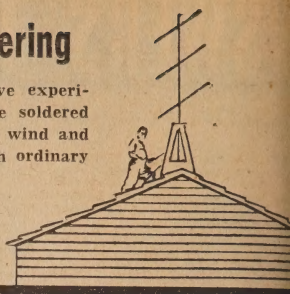

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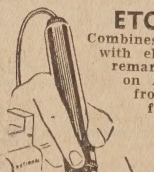

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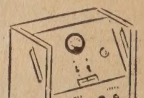

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Narraheen, NSW) sends a rather ng two-valve superhet circuit gests that it may be of use to eaders.

any thanks, S.J., and we have ur circuit for possible use in the Built It column at a later date.

(Terang, Vic.) sends a descrip- how he constructed a socket for R97 Cathode ray tube using a lastic cup and a few pieces of e.

any thanks for the contribution. nd we will file your idea for future use in the Reader Built on. In the meantime good luck e TV project but be careful with IT system.

(Warragul, Vic.) writes to tell is successful construction of the ndard Five of April, 1954, and io end of the Basic Five of March r. He also wants to know if we describe a vented enclosure for use with high quality ampli-

any thanks for the kind remarks, and we are pleased to learn that rojects have been so successful. e no immediate plans for the ion of a vented enclosure but gest that you may obtain useful m the various loudspeaker manu- s or their agents in the case of d types.

(Bayswater, WA) forwards a fur- ar's subscription and takes the nity to make some comments.

e agree that there is something id for setting out a list of refer- to previous articles associated e subject under discussion and en the idea in mind. The MBH was reviewed in the April, 1955, Our thanks for your further nts and also the subscription as been recorded by the appro epartment.

(Yeronga, Qld.) asks if we have to publish a simple tape record- uit.

ot in the immediate future, J.C. simple tape adaptor intended for conjunction with an existing r was described in the July, 1953, We would be pleased to forward of the circuit through the 2/- service if this is of any interest The adaptor takes its heater h tension power from the exist- plifier and uses two valves one amplifier and the other as an scillator.

(Prospect, SA) says he has built O but finds "that the amplifiers linear".

rom your letter it would appear u are basing your judgment on tion of a 50-cycle wave form. The would not be lack of linearity amplifiers but lack of linearity in e base. This is always a problem he time base is operating down 16 cps, as would be the case to three 50-cycle waves. You should at the linearity improves rapidly observed frequency rises above It may be possible to improve cycle linearity by experimenting e constants around the gas triode, h no radical changes should be ry.


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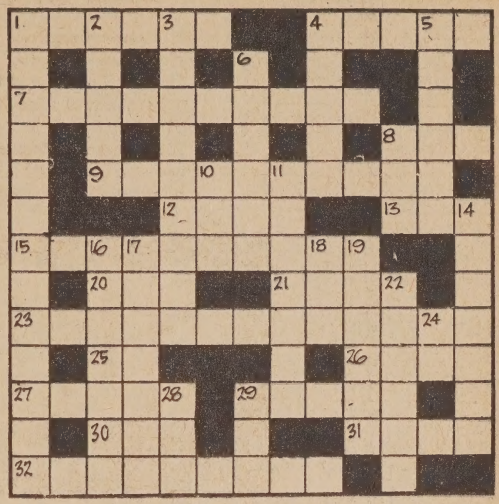
# THE R.&H. CROSSWORD No 25



## ACROSS

1. The Henry or unit of inductance.
4. Summit of a hill.
7. Used in battery portable sets (2 words).
8. River in Switzerland.
9. A test.
12. To be told.
13. A control button.
15. Result of departure from initial wave-form.
20. Pig enclosure.
21. Raised platform.
23. Permits current flow (2 words).
25. Pronoun.
26. Prefix referring to TV or films.
27. A small bay.
29. Set within.
30. Before (abbrev.)
31. Amount raised.
32. Personal attendant for an invalid.

## DOWN

1. Property resisting change in current (2 words).
2. Inductive impedance component.
3. Earpiece.
4. Attractive power.
5. Formed layers.
6. Biblical mountain.
8. Small insect.
10. Ever (poetical).
11. Exhibiting the colors of the iris or rainbow.
14. Group of cells.
16. Plunderer.
17. Instrument for checking (pl.).
18. Used in boat rowing.
19. Metallic element.
22. Set of furniture (pl.).
24. During (prep.).
28. Used in golf.
29. Girl's name.

***Solution and further crossword next month***

**R.W. (Sydney, NSW)** suggests combining a GEX33 germanium diode and an OC73 to make a loudspeaker receiver and wants to know if the scheme is feasible and whether we can help him.

A. We are afraid it isn't as easy as all that, R.W., and we think you would probably be disappointed. In any case, once a set involves the use of valves or transistors, there appears to be little point in clinging to the crystal detector. It is generally far better to use a triode or pentode as a detector which will also provide some amplification. Even so it is unlikely that a single transistor amplifier following a transistor detector would be suitable for speaker operation and two stages would probably be necessary. We refer you to the transistor circuits published in Radio, TV & Hobbies for May, June, July and August, 1955.

**B.C. (Caulfield, Vic.)** has some old parts on hand which he wishes to build into a four-valve receiver and wants to know if we have a circuit which would suit.

A. Afraid we cannot help very much, B.C., as the valves are fairly old types. The AF3 is a variable mu RF pentode and the AK2 an Octode converter. Both have four volt filaments and both are suitable for use in a small set. However, we have no data on the A68 but suggest you write to the makers who would also be able to supply additional data for the other valves. Unfortunately we have never described a set using these valves and it could be a tricky job modifying existing ones for these valves unless you knew exactly what you were doing. We do not handle component parts of any kind and you must contact our advertisers for details of prices and supply.

**K.G. (Kingsgrove, NSW)** is interested in the 2-Band Transmitter featured in the June, 1953, issue and wants a parts list for it.

A. Sorry, K.G., but the fact that no parts list was published means there are none available. We can only supply copies of those circuits, &c., which have been already published. In any case there is sufficient information in the circuit to allow any advanced amateur to compile his own parts list.

## Last Month's Solution

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F | I | L | A | M | E | N | T | | F | | D | | | |
| I | | I | | A | | R | E | L | A | Y | S | | | |
| L | E | C | H | E | R | W | I | R | E | | E | | | |
| T | | E | | | T | H | E | R | M | | I | | | |
| E | O | N | S | | H | E | S | S | I | A | N | | | |
| R | | C | O | P | S | E | | | N | | G | | | |
| C | L | E | F | | | L | O | D | G | E | | S | | |
| I | | T | | A | S | I | A | | B | B | C | | | |
| R | | A | V | C | | | L | T | | O | | A | | |
| C | | | A | L | P | A | C | A | | N | | N | | |
| U | V | U | L | A | | L | A | | H | I | S | S | | |
| I | | | V | I | K | I | N | G | | T | | | | |
| T | O | T | E | M | | | S | C | R | E | E | N | | |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# WANTED TO BUY, SELL OR EXCHANGE

**SELL:** Radio and Hobbies Vols. 2, 3, 4, 5, 6 and 7 (April 1940 to March 1956). All bound £7/10/- the lot. **Ring JX2479 (Sydney).**

**SELL:** Aluminium foil for shielding, 24in x 18in x 3/1000in, 1/6 a sheet. **B. H. Knight, 2 Quondone St., North Brighton, Adelaide.**

**SELL:** Just under one hundredweight R. & H. 1939-1954, few duplicates, some missing, one lot only; any or best offer not necessarily accepted, will advise successful applicant only. Price 30/- plus rail freight. Send no money with first letter. **Brooks, P.O. Box 340, Mackay, Qld.**

**SELL:** Thorens CBA83 Automatic Record Player with new type Diamond and Sapphire Stylus Assembly. Perfect condition; also new Sapphire Stylit. Cost £60, sell £40. **Jenkins, Box 830L, GPO, Brisbane, or FW1533.**

**SELL:** TR119GA 12-volt trans-ceiver new in case. BC348R communications recr. Excellent order 240V A.C., speaker and extra output stage. BC342 comm. recr. all there, valves OK needs some work. **O'Brien, Care P.O. San Remo, Victoria.**

**SELL:** UHF gear receiver BC639A, 100-155 mc calibrated dial, 5 meter RF and Audio gain etc., £15. SCR522 £15. Transmitter BC625A, £12 all complete. **J. G. MacIver, 2 Hurd Terrace, Morningside, Brisbane.**

**SELL:** 2-speed heavy duty motor and turntable. Also new H.G.P.38 P.U. £18 the lot. **C. Douglas, Tiral St., Charlestown, NSW.**

**SELLING** out workshop. Amplifier, test gear, valves, parts. **FX8276.**

**SELL:** Speakers with "tranys" two 12in 15W Rolas, two 10in 10W. Also Goldring 200 P.U. one R.C. 70B Garrard changer. Sell as new. **K. Thompson, 348 Milton Rd., Auchenflower, Brisbane. U4559.**

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**SELL:** R. & H. back issues 75 Sept. '49 to Nov. '55. All perfect any reasonable offer. **Donaldson, Swan St., Tuart Hill, WA.**

**SELL:** Ferrograph Hi-Fi tape recorder, showroom condition, response flat from 2-13000 c/s only done eight hours recording. £195 or near offer. **G. Watson, 2 Redcourt Av., Armadale, Vic. UY5379.**

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**FOR SALE:** Collaro 3-speed transcription unit as new £25. Tape deck "Nova" with carrying case £20. 3-speed V.A. Model 104 changer with carrying case £16/10/-. **Write "Radio" P.O. Box 228, Tamworth.**

**FOR SALE:** Transceivers Type 101 with valves. Set only—good order, £7/10/- each. F.S.6, Type Power Supplies (No Cables). Good order. £6/10/- each. **Hardinge Bros. Pty. Ltd., Horsham, Victoria.**

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**HI-FI for Pleasure:** A guide to equipment by Burnett James, 15/9 post 6d. "Engineers' Dreams" (general projects), by Willy Ley, 18/9 post 9d. **TECHNICAL BOOKSELLERS, 56 Hunter St., Sydney. BW7981.**

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